DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

AUGUST, 1942

Torpedo patrol boats, submarine chasers, and other small craft in combat service are being driven by engines built in a prominent Pacific Coast plant in ratings up to 1000 H.P. The leading article in September MACHINERY will deal with the methods used in manufacturing these engines on a quantity production basis. Other articles of special interest at this time will deal with instructing new supervisors in plants converted to war work and with effective ways of instructing operators. An unusual article will discuss the speeding of blueprint deliveries in large plants and another article, the economy of welded construction.

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Number 12

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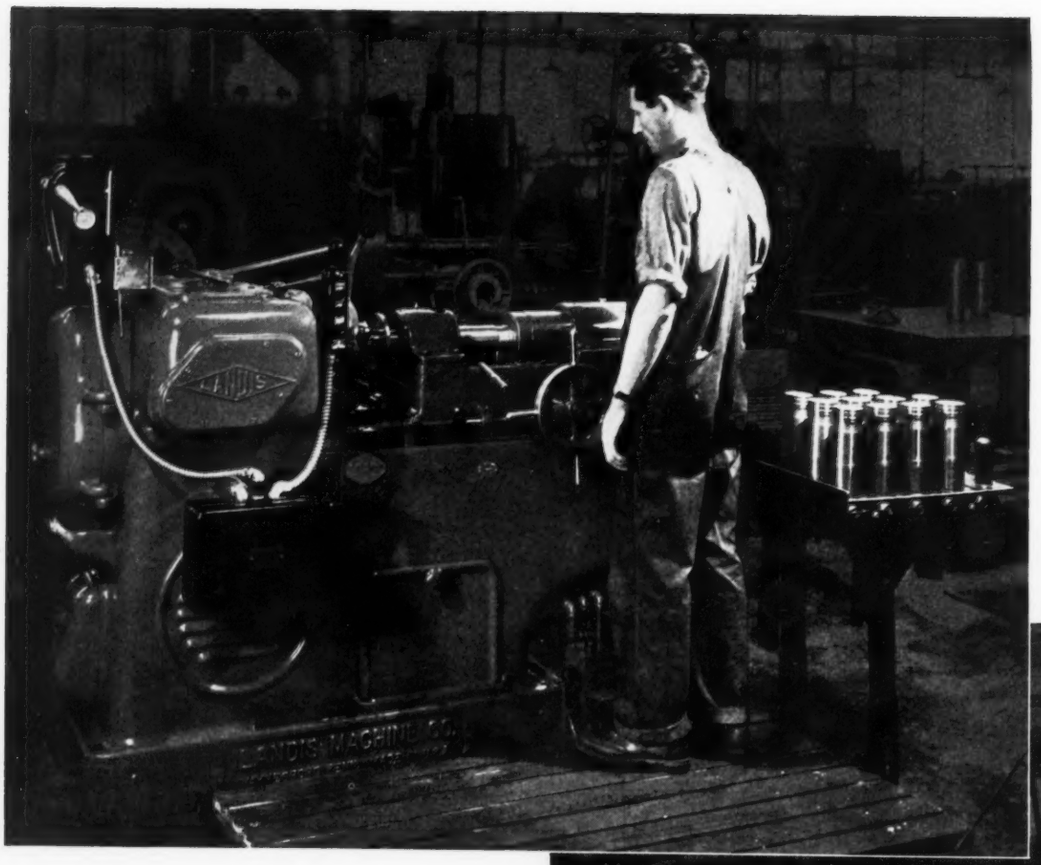

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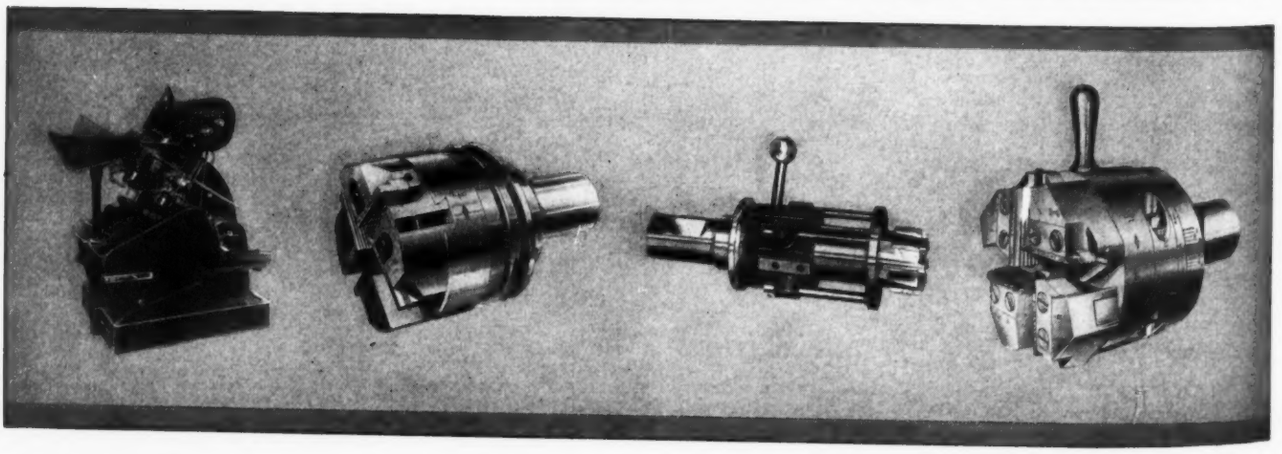


MACHINERY

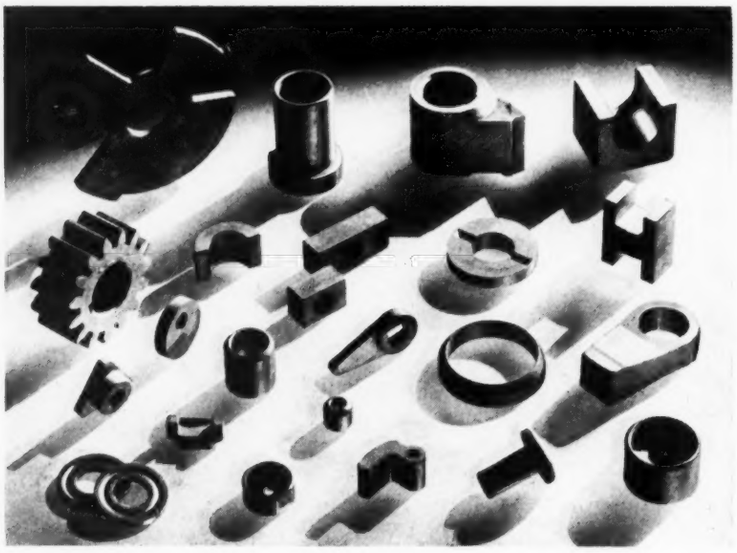
Volume 48 NEW YORK, AUGUST, 1942 Number 12

Powdered Metals in Machine Design

Principles Involved in Making Parts from Compressed Metal Powder—Based on the Practice of the Moraine Products Division of the General Motors Corporation
First of Two Articles

WHILE the art of powder metallurgy actually is more than one hundred years old, its application is still in its infancy; and although numerous papers have been read before scientific and engineering societies, and occasional articles have appeared in the technical press on the subject of producing powdered-metal parts, to the average engineer and machine designer the process is new and his knowledge of it is comparatively limited. Yet powder metallurgy opens up an entirely new and highly important field in machine construction, and the technique of the production of powdered-metal parts is as basic in its principles as drop-forging, casting, or machining. New uses are being found for powdered-metal parts daily, and this new method is constantly becoming more essential to industry.

Briefly, powder metallurgy makes it possible to compress metal particles, so finely divided



Examples of Parts Made from Powdered Metals

that they appear like flour or dust, into finished metal parts through the application of pressure and heat. The process does not involve any melting, casting, forging, rolling, extruding, or hammering of the metal; and seldom is it necessary to do any machining work on the finished part. Bronze is the principal metal that has so far been used in making commercial metal-powder parts. However, iron powder is rapidly becoming the leader, because of the present scarcity of copper and tin.

Advantages Gained by Forming Parts by the Powdered-Metal Process

The first question that an engineer will ask is: What are the advantages of forming parts in this manner? Briefly, powder metallurgy results in great savings in time, materials, labor, and machines. It is possible to shape many parts more rapidly and cheaply than could be done by machining from solid stock. Many parts ordinarily made on automatic screw machines can be made by the new process; cams and irregular-shaped machine parts lend themselves well to this procedure; and gears for automobile oil-pumps, for example, may be so made.

When powder metallurgy is used, there is no scrap whatever. Consider gears as a case in point. When made by conventional methods, the scrap may run as high as 70 per cent; not only is there thus a great saving in material when the new process is used, but the manufacturing time is cut to less than one-half. Yet the final product has the mechanical strength of a machined cast-iron gear, with a reduction of 25 per cent in weight. The powdered-metal gear also has exceptional resistance to wear.

The size of the particles of the metallic powders used in making powdered-metal parts ranges from 0.006 to 0.0001 inch. These powders are either accurately measured into a die, or the die is completely filled with the powder, after which it is compressed by a plunger under pressures as high as 100,000 pounds per square inch. This operation is known as "briquetting," because the powder is squeezed together into a briquette. The shape of the briquette is an accurate reproduction of the die; if the piece formed from the compressed powder is a gear, it has accurately formed tooth surfaces that appear as if they had been polished. As it comes from the die, however, the piece can be broken up with the fingers and crumbled again into powder.

To weld the "green briquette" (as it is called) into a strong mass, it is next placed in a furnace, the atmosphere of which is controlled to exclude oxygen and reduce any oxides present. In this furnace, the powdered-metal parts are heated to a temperature below the melting point of the metal. This operation is known as "sintering." When the piece emerges from the heating furnace, it has not changed in appearance, except for color, but it can no longer be crushed between the fingers, because it has been transformed from compressed dust into a metal in many respects similar to cast materials. Thus, by the application of tremendous pressure and a temperature below the melting point, a hard strong metal piece, accurate in dimensions, has been produced.

Some Properties and Applications of Powdered-Metal Parts

In the sintering of all powdered metals, the part being made is porous. Any desired porosity from 5 to 50 per cent can be obtained. It is this porosity that has accounted for the most widespread application of powdered-metal parts up to the present time—that is, in porous oil-retaining bearings. More than a billion of these bearings are now in use (constantly lubricating their shafts) in electrical household appliances, automobiles, and other equipment in general use. In addition to machine parts, the tungsten filaments of electric lamps and newly developed filters for the chemical industries are examples of the powder metallurgist's art as it has developed up to the present. What tomorrow may bring in this field may be surmised from the tendency toward larger and more complex units. It is also being more and more recognized that

powder metallurgy opens the way for many low-cost mass-production metal parts.

The fact that there is no waste of material is a factor that is strongly in favor of powdered metals. The finished part contains exactly the same amount of material as was used from the start. There are no fins, no flash, no scale or chips, and no metal scrap such as produced when stamping parts from sheets.

Importance of Process in Saving Scarce Metals

Of considerable importance at the present time is the fact that powder metallurgy makes it possible to use iron and iron alloys in places where alloys of copper, zinc, or aluminum were necessary in the past. Since the powders are never melted, parts produced from them are porous and can be impregnated with lubricants, so that iron-alloy bearings may be substituted for bronze bearings, as an apparently solid bearing may be composed of up to one-third oil. It is also possible to use this process for tungsten, tantalum, and molybdenum, the melting points of which are very high—so high, in fact, that it would be impractical to use them if they had to be melted.

Some products now being made from powdered metals are electric motor parts; bearings; diamond drill bits; airplane instrument parts from brass and bronze; parts of motion picture cameras and clocks; electric contact points; and filters.

The electrical industry has found that powder metallurgy provides the answer to many difficult problems. For example, electrical contacts with special properties are simply made from metal powders. A contact material that is an excellent conductor of electric current and yet resists any tendency to fuse or stick in operation can also be so produced. The reason for this is that the silver and copper powders required for high conductivity can be combined with high-melting metal powders such as tungsten or molybdenum.

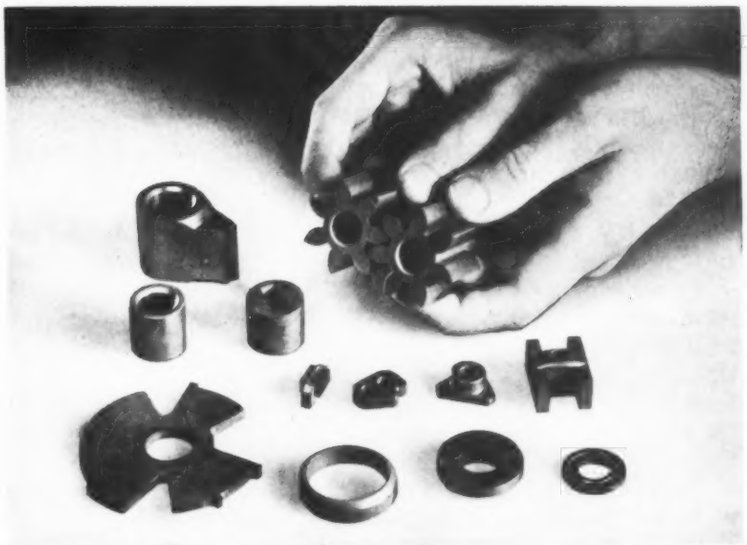
Some of the parts now made specifically from iron powder are radio tuning brakes, which are turned out at low cost, with high hardness and close tolerances; automobile oil-pump gears, in which strength and accuracy are obtained at savings in both materials and machining costs; guide blocks for machine saws, which have not only the required hardness, but also self-lubricating qualities that reduce wear; and cams for various types of machines, which require no special machining or finishing operations.

Historical Notes on Powder Metallurgy

Powder metallurgy was developed more than one hundred years ago by chemists who found that their furnaces could not develop enough heat to melt platinum. A hundred years later, scientists in search of a method to make use of the almost unmeltable tungsten metal to form filaments for incandescent lamps took up the work where the platinum chemists had stopped. During this work with tungsten, German scientists developed tungsten carbide for cutting tools.

It was at this stage of the development, in the early 1920's, that the General Motors Corporation became interested in powder metallurgy. Mr. Kettering and his research laboratory were working on an air-cooled engine for automotive use. The problem of lubricating the rocker-arm bearings was a difficult one, and a self-lubricating bearing was thought to be the solution. To make such a bearing on a commercial basis was a problem to be solved by the manufacturing section of the research laboratories.

After a year of work, a successful bearing was produced; but by that time, the air-cooled engine project had been dropped and the new bearing had to find other uses. It was first applied as a generator bushing in a Delco-Remy product, and millions of such bushings have been used for that purpose ever since. These bearings were first called "Grapho-Bronze," being composed of bronze and graphite. In 1924, an oil-



Additional Examples of Parts Made from Powdered Iron. These are Replacing the Machined Parts Formerly Used

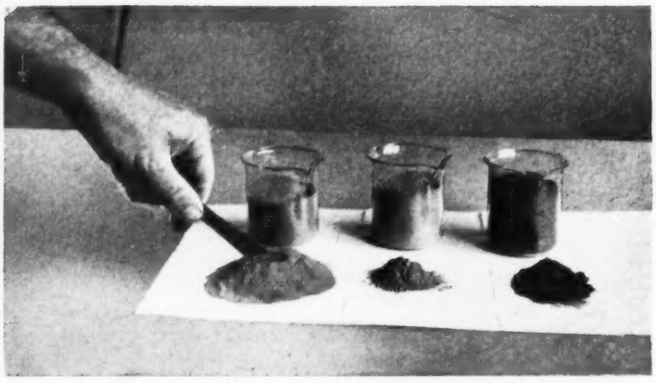


Illustration Showing the Relation of the Amounts of Copper, Tin, and Graphite Powders Used to Make "Durex" Metal Bearings

impregnated bearing was developed which was put on the market under the name "Durex." The home appliance manufacturers have offered an ideal market for these bearings, and they are now employed in washing machines, electric refrigerators, stoves, mixers, and many other appliances.

Porex—A Filtering Material Made from Powdered Metal

Gradually the process was developed so that, in addition to bearings, parts for a multitude of other purposes were being made by this new method. Subsequently, a porous filter under the name of "Porex" was developed, which has proved to be an important step in the application of powdered metals. Porex is the first really new application of powder metallurgy which has established itself independently of the bearings and powdered-metal parts business.

Porex is a porous metal, the chief functions of which are to break up into small streams the main flow of a fluid to remove (or filter out) undesirable materials, such as foreign particles from oil; to separate two fluids; and to serve as a diffusing medium in bringing fluids and gases into intimate contact under controlled conditions.

As an example of the application of this material may be mentioned its use as an auxiliary feed for supplying lubricant to bearings of continuously operated equipment. A small orifice leading from the oil reservoir to the bearing is protected against clogging by a Porex filter. If the main flow of oil supply to the bearing fails, a steady flow of oil is metered to the bearing by the Porex filter for from six to eight hours, giving time to make necessary repairs to the main oil supply. The auxiliary feed is fully automatic and simple in design, installation, and maintenance.

One of the most spectacular applications of this new product is in the modern high-speed Diesel engine. Fuel injectors force oil through a fine spray nozzle under pressures as high as 25,000 pounds per square inch. The slightest particle of foreign matter in the fuel oil would clog the injector and put it out of service in a short time. Such foreign matter is being removed by Porex filters.

An Important Step Forward—Parts Made from Iron Powder

It was in 1936 that iron powder was first studied with the object of making all kinds of parts by the new process. In the beginning, a pure, cheap iron powder was made from Swedish sponge iron, but the supply of this powdered iron was cut off at the beginning of the war. Scrap steel is now being used, instead, by processing it into powder.

The iron process was perfected less than three years ago. It is so new and revolutionary in its possibilities that many designing engineers know little about it. In fact, until the entry of the United States into the war, powdered iron was used mainly for bearings, gears, and miscellaneous metal parts. Some of the applications proved very valuable, as in the case of textile machine construction, where corrosive conditions preclude the use of bronze or alloys containing copper, and where lubrication is a problem because of the danger of oil dripping down on the fabrics in process. Still more important is the fact that, through the use of iron powder, machining is saved, as well as important scarce materials.

Where Powdered-Iron Parts are Applicable

Powdered iron is especially applicable to bearings, gears, cams, and miscellaneous metal parts wherever wear resistance, surface smoothness, and comparative ease of manufacture recommend this material. It is especially suitable when large-scale production is possible and close tolerances are demanded.

Specifically, the process is advantageous when irregular curves, eccentrics, and radial projections and recesses are required. Where a part has irregular holes, keyways, flat sides, splines, or square holes that are not easily machined, powdered-metal parts may solve the problem. Tapered holes and counterbores are easily produced. In tapered holes, a short length at the small end should be cylindrical. Axial projections can be formed, but the permissible size of such projections depends on the ability of the powder to flow into the die recesses. Projections not more than one-fourth the length of the part

are practicable; slots, grooves, blind holes, and recesses of varying depths are also obtainable. Here the savings are marked, since accurate tool set-ups and machining operations are avoided.

Specific Advantages of Powdered-Iron Parts

The introduction of iron as a material for powdered-metal parts has many important advantages. The raw material—steel scrap or other by-products from metal-working operations—is always available. The molded products can be used as machine parts or bearings without machining. At the present time, the use of iron as a substitute for bronze in bearings is of importance in order to conserve a material urgently required for the manufacture of munitions. For the last three or four years, bronze bearings have been replaced by porous iron bearings with satisfactory results.

Briefly, porous iron bearings have the following advantages:

1. The porosity of the bearing is approximately 20 per cent of the volume, making it possible for the bearing to retain that proportion of lubricant.

2. They are made of practically pure iron and graphite, which results in a modified pearlitic structure, with additional free graphite to provide good bearing properties. The structure is uniform; there are no hard spots and no internal stresses.

3. The bearing is finished by burnishing in the sizing operation. This gives a very high finish. The operation is easily performed on a porous bearing because it is compressible.

4. At the present time, the making, by the powdered-metal process, of parts that would normally be screw machine products is of importance. Screw machines are now at a premium and cannot be built fast enough to meet the war demand. Incidentally, it is often possible to produce a powdered-metal part cheaper than the same part could be made on an automatic screw machine; and should there be any milling or other operations required under ordinary conditions, these are eliminated by the powdered-metal process. Furthermore, when time is saved on machines, as a rule it also means labor saved; we are so many man-hours to the good. In short, powder metallurgy offers a method of producing more parts, faster, and with less work during this extremely critical period.

5. The elimination of scrap is in many cases a deciding factor. In the making of thrust washers and similar parts from rolled stock, one-half to three-fourths of the amount of metal used may be scrap; but as mentioned, in the powdered-metal process there is no scrap whatever. This conserves our vital fabricating facilities, which are so very important at this time.

Pressures Used in Briquetting Powdered Metal

The pressures required for forming parts from metal powders may range from 10 to as much as 50 tons per square inch. This means that presses relatively large in proportion to the product are required. The larger the piece made, the larger the press needed. This fact has made it rather uneconomical to produce large pieces by this process, since the cost of the equipment becomes very high as the pressures mount. There is, however, a decided trend toward high-capacity presses. Almost a year ago one of the largest fabricators of parts from metal powders was using presses of 80 tons capacity on production work.

It is a curious fact that most of the presses now turning out parts from metal powder are adaptations of machines originally designed for making pharmaceutical tablets. There is an opportunity in this field for the development of machines especially intended for powdered-metal manufacturing.

As a means for avoiding extremely high pressures, experiments are being made with hot pressing—that is, heating the metal powders after the preliminary "compacting." The heat causes them to become somewhat plastic, and, hence, they are more easily compressed. There

Group of Powdered-bronze Parts Used in Munitions Manufacture and Ordnance Equipment

are, however, limitations to this procedure, since the dies required are more expensive and production not so fast.

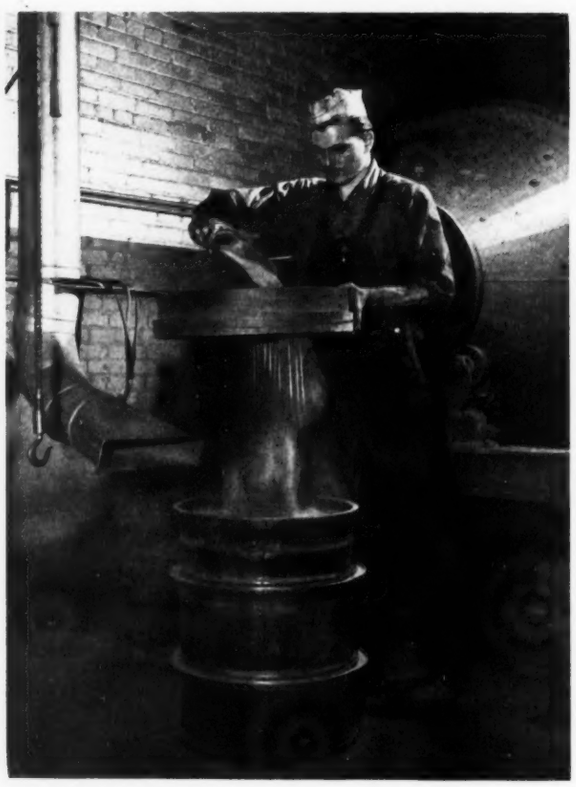
While the limitation of the size of parts is chiefly a matter of size and power of presses, products of complicated shape cannot yet be formed by this method. The chief reason for this is that metal powders do not flow around corners, as molten metal does in die-casting, for example. However, by combining machining operations with powdered-metal forming, many parts can be obtained more cheaply, and certainly much more rapidly, than by machining alone.

Since the shape of the part has a great deal to do with the practicability of forming it from powdered metals, the design of the product must be carefully considered. For example, if a cast-metal part is to be replaced by one made from powdered metal, it will probably have to be redesigned to avoid projections, flanges, etc., that were easily made from molten metal.

Punch and Die Used for Making the Part Seen on the Die from Powdered Metal

Application of Powdered Metals in Durex Bearings

As mentioned, among the important products of the powdered-metal process are metallic bearings of porous structure known by the trade name "Durex." These bearings differ from ordinary solid bearing materials in that the lubricant is contained in the pores of the material itself. This lubricant is available at the bearing surface without the need of an external supply of oil. Oil-holes through the bearing walls or grooves in the bearing surfaces are not necessary, because the oil reaches the bearing surface by feeding through the material of the bearing itself.

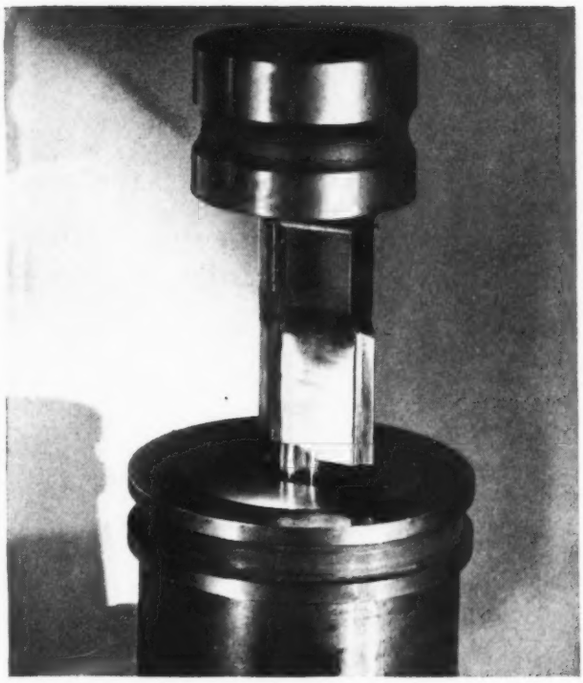


Sifting Iron Powder preparatory to Mixing it with the Proper Amount of Graphite for Bearing Bushings

These bearings are made from several compositions. No one composition is suitable for all applications. Bronze bearings are most widely used, made directly from copper and tin powders. Other metals (such as lead and iron) and non-metallic materials (such as graphite) are also used in making porous bearings. These bearings are now made in a wide range of sizes, from a few hundredths of an inch to several inches in diameter, and in weights from a fraction of an ounce to several pounds.

When the oil is inside a porous material, it is more quickly available to the bearing surfaces than when fed to them by external means; hence, there is assurance of a protective oil film at all times. In one Durex bearing application, shafts have been running under light load continuously for four years without measurable wear on either shaft or bearing.

An interesting point is that the rate of oil flow through the wall of a porous bearing can be varied over a wide range to suit the requirements. Some of the factors affecting the rate



Another Punch and Die Employed for Producing a Powdered-metal Part

of flow are the extent of the porosity of the bearing bushing, the size of the pores, the viscosity of the oil, the operating temperature, and the condition of the wall surfaces of the bearing bushings.

Powdered Metallurgy Used in Making Babbitted Bearings

A number of years ago it became evident that the trend toward better performance in automobiles, combined with lighter engines, would require greatly improved main and connecting-rod bearings. It was determined that, as far as the material was concerned, a high-lead babbitt with sufficient tin and antimony to resist corrosion would be ideal. The difficulty was that if a thick layer of babbitt were used, it would crack and fail under heavy loads; if a very thin layer—all that was necessary theoretically—were used, it was found almost impossible to bond it securely to its shell.

The porosity obtainable by powder metallurgy suggested that some sort of matrix could be developed to bond the babbitt firmly in place. Experimentally, a mixture of copper and nickel powder was applied to a strip of sheet steel. During the sintering, the copper worked down in between the grains of the steel strip to form a strong mechanical bond, and at the same time, welded the particles of nickel together, producing an extremely strong porous framework, something like a sponge. Since these bearings will operate under considerable loads, the matrixes are preloaded or compressed between steel rolls under pressures up to 10,000 pounds per square inch. In that way, subsequent operating pressures of from 2000 to 4000 pounds will not crush the matrix.

The spongy preloaded matrix was firmly bonded to the steel shell, but the next problem was to bond the babbitt to the matrix. The ingenious solution was to exhaust air from the pores of the matrix by a vacuum and to force the babbitt into the pores under atmospheric pressure, so that a final surface layer of babbitt was formed, not much more than 0.002 inch thick, but very firmly locked in place. Road tests conducted by the Buick organization have shown that the new bearing outlives old types from two to five times.

The Production of Alnico Parts

Another product that is now in process of commercial production illustrates the broad applications of the powdered-metal process. The iron-aluminum-nickel-cobalt magnetic alloy Alnico presents casting and machining difficulties that have hampered the application of this valuable material in permanent magnets. The alloy is not an easy one to cast without imperfections because of its composition, and the castings themselves are so hard and difficult to machine

The Die "Barrel" and Punch are Fitted to Very Close Tolerances, but Permit the Air to be Forced out under High Pressure

that they must either be ground or machined with carbide tools. Small magnets of complicated shapes are, therefore, very expensive. It has been found, however, that the small Alnico magnets used in meters and other small electrical devices can be produced efficiently and less expensively from metallic powders. They are pressed to shape from the powders and require little or no finishing. Here the new method is much more economical than any other.

In the second and concluding installment of this article, the processing of powdered-metal parts through the shops of the Moraine Products Division of the General Motors Corporation will be described. The briquetting, sintering, and oil impregnation will be referred to in detail; the procedure of making babbitted main and connecting-rod bearings will be outlined, and the method of making powdered-metal gears will be described; the properties—primarily the strength of these powdered-metal gears—will be discussed in some detail; and finally, the possibilities and limitations of the powdered-metal process will be covered.

Effect of the New Priority Directives on Machine Tool Deliveries

IT is important that executives in the machine tool using industries should be thoroughly familiar with the significance of the new priority directives, specifically the No. E-1-b Priority Regulation, under which the War Production Board has complete control of the deliveries of all machine tools. This control is exercised primarily under the priority system in order that equipment most urgently needed may be delivered at the earliest possible date, taking precedence over other orders.

A prominent machine tool builder calls our attention to the fact that the machine tool manufacturer no longer has any discretion in the matter of deliveries and that he cannot now "accommodate" an old and valued customer at the expense of another customer. Hence, it is no longer possible for a customer to bring any pressure to bear upon a machine tool builder to secure earlier delivery of the equipment that has been ordered for his plant.

If his need for the equipment is urgent, his only recourse is to present his case to the War Production Board in Washington, giving complete details about the order and the purpose of the equipment to be delivered. The War Production Board alone has the authority to advance the delivery date. This is an important point that must be understood by all who have machine tools on order. If that point is thoroughly appreciated, it will not only relieve the machine tool builder of a long chain of telegrams and long-distance telephone calls, but will also direct the buyer's efforts into the right channel.

There is another point in this connection that few purchasers of machine tools thoroughly appreciate, and that is that the position of any one order is constantly changing in the machine tool builder's delivery schedule. At the time an order is placed, for example, November delivery may be agreed upon; but this delivery may easily be deferred until March, if new orders that are deemed more urgent by the War Production Board are received in the meantime. Once an order is entered, it is subject to constant fluctuations, since cancellations, new orders, and diversions of deliveries constantly change the picture. One manufacturer states that there are several instances where the delivery position of a certain order has changed as many as a dozen times in one day.

This constant change obviously causes many difficulties; but, on the other hand, it is easy to understand that delivery schedules must be kept flexible, due to the quickly changing events in the war, which make it necessary for Army and Navy men to constantly arrive at new decisions as to what type of munitions are most vitally needed at the moment. If the emphasis this month is placed on aircraft carriers, it may have to be done at the expense of tanks, and it may be deemed advisable by those in authority to place a higher urgency rating on machinery destined for manufacturing operations in connection with carriers and to defer the deliveries of machine tools for tank production for the moment. The changes are based on necessity and to meet conditions that arise from day to day on the battlefronts—on land, on sea, and in the air.

* * *

In shipbuilding, electrodes 1/8 and 5/32 inch in diameter have been largely used in welding. If these are changed to 3/16 and 1/4 inch, the speed of welding can be more than doubled. The total cost of the electrodes would also be reduced. "The great problem is not more welders and more shipyards, but more efficiency with what we now have," says J. F. Lincoln, president of the Lincoln Electric Co.

MACHINERY'S DATA SHEETS 471 and 472

RECOMMENDED TOOL ANGLES FOR CARBIDE TOOLS—3

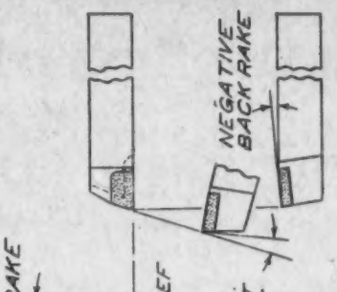


FIG. 2

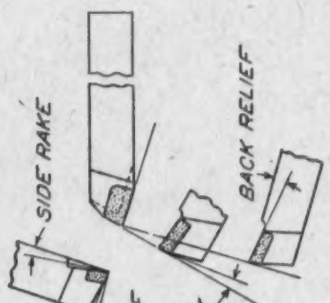


FIG. 1

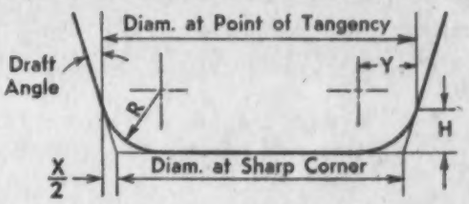
Material	Relief (Degrees)*		Rake (Degrees)*	
	Front	Side	Back	Side
Malleable Iron (For Average Work)				
Hard	4–6 (5)	4–6 (5)	0–6 (0)	0–8 (5)
Medium	4–8 (7)	4–8 (7)	0–6 (0)	0–10 (8)
Soft	4–8 (7)	4–8 (7)	0–6 (0)	0–12 (8)
For Large Work where High Cutting Speeds are Not Practical				
Hard	4–6 (5)	4–6 (5)	0–6 (5)	0–8 (5)
Medium	4–6 (5)	4–6 (5)	0–6 (5)	0–10 (8)
Soft	4–8 (6)	4–8 (6)	0–6 (5)	0–12 (8)
Brass and Bronze (For Average Work)				
Hard	4–6 (5)	4–6 (5)	0–5 (0)	4–8 (4)
Soft	6–8 (7)	6–8 (7)	0–10 (0)	4–10 (8)
For Large Work where High Cutting Speeds are Not Practical				
Hard	4–6 (5)	4–6 (5)	0–5 (0)	4–8 (4)
Soft	6–8 (6)	6–8 (6)	0–10 (0)	4–10 (6)
Copper (For Average Work)				
All	7–10 (7)	7–10 (7)	6–10 (8)	15–25 (15)
For Large Work where High Cutting Speeds are Not Practical				
All	7–10 (7)	7–10 (7)	5–10 (8)	8–15 (15)
Miscellaneous				
Hard Rubber	6–10 (7)	6–10 (7)	15–35 (20)	8–25 (10)
Soft Rubber	8–15 (10)	8–15 (10)	15–35 (25)	8–25 (20)
Commutators	3–8 (7)	3–8 (7)	0–10 (8)	8–20 (15)
Fiber and Plastics	6–10 (7)	6–10 (7)	0–10 (5)	8–15 (10)

*Figures in parentheses are "safe" starting angles on new jobs. The other figures indicate the range of practical angles.

MACHINERY'S Data Sheet No. 471, August, 1942 Compiled by Carboloy Company, Inc.

POINT OF TANGENCY TABLE

This table can be used to determine the dimensions for sinking dies for rounded, dished vessels as shown in the accompanying diagram. If the diameter of the vessel at what would be the sharp corner if it were not rounded is given, together with the radius *R* of the rounded corner and the draft angle of the side, then the height *H* of the point where the rounded corner meets the inclined straight side (point of tangency); the horizontal distance *Y* between the center of the arc forming the rounded corner and the point where the rounded corner meets the inclined straight side; and the diameter at the points of tangency can be determined with the aid of this table.



Example:
$R = 1\ 9/32 = 1 + 1/4 + 1/32$
Draft Angle = 15 degrees
Diameter at Sharp Corner = 6.000

$H = 0.741 + 0.185 + 0.023 = 0.949$
$X = 0.397 + 0.099 + 0.012 = 0.508$
$Y = 0.966 + 0.242 + 0.030 = 1.238$
Diam. at Tang. = 6.000 + 0.508 = 6.508

Radius R	Draft Angle = 5 Deg.			Draft Angle = 7 Deg.			Draft Angle = 10 Deg.			Draft Angle = 12 Deg.			Draft Angle = 15 Deg.		
	H	X	Y	H	X	Y	H	X	Y	H	X	Y	H	X	Y
1/64	0.0143	0.0025	0.0156	0.0137	0.0034	0.0155	0.0129	0.0046	0.0154	0.0124	0.0053	0.0153	0.0116	0.0062	0.0151
1/32	0.0285	0.005	0.0311	0.0274	0.0067	0.0310	0.0258	0.0091	0.0308	0.0248	0.0105	0.0306	0.0232	0.0124	0.0302
1/16	0.0571	0.010	0.0623	0.0549	0.0135	0.0620	0.0516	0.0182	0.0616	0.0495	0.0210	0.0611	0.0463	0.0248	0.0604
3/32	0.086	0.015	0.0934	0.082	0.020	0.0931	0.077	0.027	0.0923	0.074	0.031	0.0917	0.069	0.037	0.0906
1/8	0.114	0.020	0.125	0.110	0.027	0.124	0.103	0.036	0.123	0.099	0.042	0.122	0.093	0.050	0.121
3/16	0.171	0.030	0.187	0.165	0.041	0.186	0.155	0.055	0.185	0.149	0.063	0.183	0.139	0.075	0.181
1/4	0.228	0.040	0.249	0.219	0.054	0.248	0.206	0.073	0.246	0.198	0.084	0.245	0.185	0.099	0.242
5/16	0.285	0.050	0.311	0.274	0.067	0.310	0.258	0.091	0.308	0.248	0.105	0.306	0.232	0.124	0.302
3/8	0.342	0.060	0.374	0.329	0.081	0.372	0.310	0.109	0.369	0.297	0.126	0.367	0.278	0.149	0.362
7/16	0.399	0.070	0.436	0.384	0.094	0.434	0.362	0.128	0.431	0.347	0.147	0.428	0.324	0.174	0.423
1/2	0.456	0.080	0.498	0.439	0.108	0.496	0.413	0.146	0.492	0.396	0.168	0.489	0.370	0.198	0.483
9/16	0.514	0.090	0.560	0.494	0.121	0.558	0.465	0.164	0.554	0.446	0.189	0.550	0.417	0.224	0.543
5/8	0.570	0.100	0.623	0.549	0.135	0.620	0.516	0.182	0.616	0.495	0.210	0.611	0.463	0.248	0.604
11/16	0.628	0.110	0.685	0.604	0.148	0.682	0.568	0.200	0.677	0.545	0.232	0.673	0.510	0.273	0.664
3/4	0.685	0.120	0.747	0.658	0.161	0.744	0.620	0.219	0.739	0.594	0.253	0.734	0.555	0.298	0.724
13/16	0.741	0.130	0.809	0.713	0.175	0.806	0.671	0.237	0.800	0.643	0.273	0.795	0.602	0.323	0.785
7/8	0.798	0.140	0.872	0.768	0.188	0.869	0.723	0.255	0.861	0.693	0.294	0.856	0.648	0.347	0.845
15/16	0.856	0.150	0.934	0.823	0.202	0.931	0.774	0.273	0.923	0.742	0.316	0.917	0.694	0.372	0.906
1	0.913	0.160	0.996	0.878	0.215	0.993	0.826	0.292	0.985	0.792	0.337	0.978	0.741	0.397	0.966
2	1.826	0.320	1.992	1.756	0.431	1.985	1.653	0.583	1.970	1.584	0.674	1.956	1.482	0.795	1.932
3	2.739	0.480	2.988	2.634	0.647	2.978	2.479	0.875	2.954	2.376	1.011	2.934	2.224	1.192	2.898
4	3.651	0.640	3.985	3.513	0.863	3.970	3.305	1.165	3.939	3.168	1.348	3.913	2.965	1.590	3.864
5	4.564	0.800	4.981	4.391	1.079	4.963	4.132	1.457	4.924	3.960	1.685	4.891	3.706	1.987	4.830
6	5.477	0.960	5.977	5.269	1.295	5.955	4.958	1.749	5.909	4.753	2.022	5.869	4.447	2.384	5.796

MACHINERY'S Data Sheet No. 472, August, 1942 Compiled by H. W. Gerlach

Keeping the New York Central's Four Thousand Locomotives Running

By CHARLES O. HERB

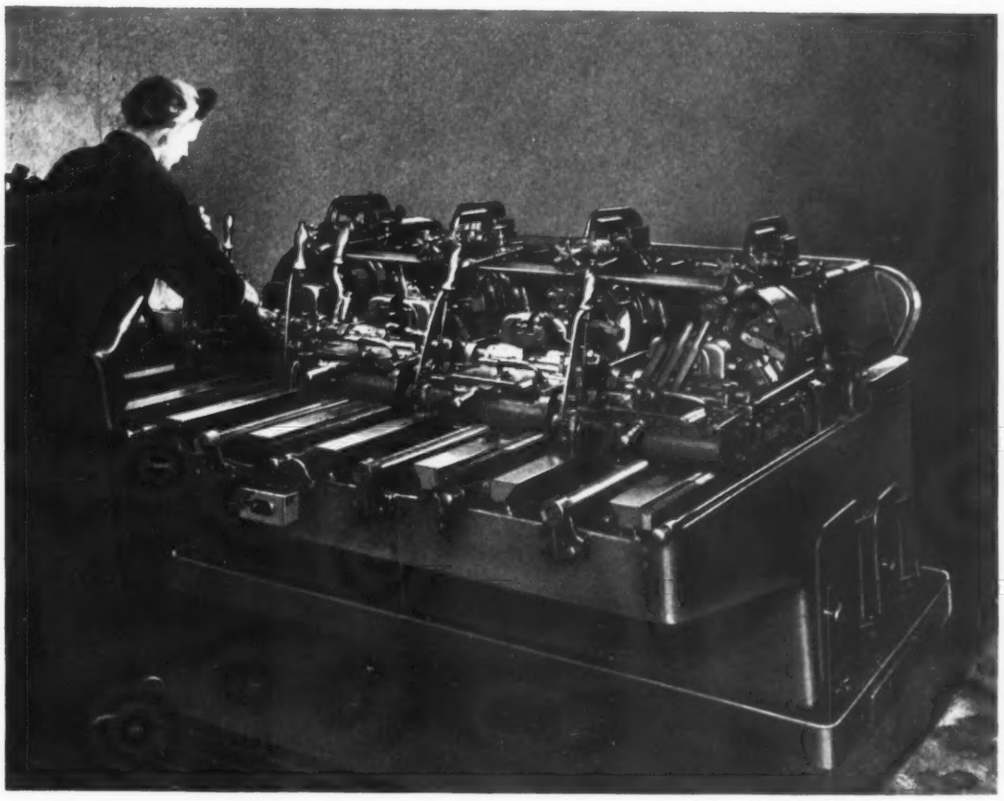


Fig. 14. Quadruple-head Bolt-cutter Set up for Turning the Bolt Shank with One Head and Threading with Three Remaining Heads

OPERATIONS performed in the Beech Grove and Collinwood maintenance shops of the New York Central Railway System, and some of the modern equipment employed, were described in the first installment of this article, which appeared in April MACHINERY. Additional operations are described in this, the concluding, installment.

A quadruple-head Acme bolt-cutter is shown in Fig. 14 set up for cutting threads on flexible staybolts 1 1/16 inches in diameter. The threaded length is 4 inches. One head turns the bolts to the required diameter, and the other three heads are employed for threading. Die-heads with tangential chasers are used. The threads are cut true as to pitch diameter within 0.002 or 0.003 inch. Lead-screws control the pitch of the thread. The chasers can be conveniently adjusted in a radial direction by small handwheels, for cutting different thread diameters.

The operation shown in Fig. 15 consists of grinding the air and steam sides of a cross-compound air-pump cylinder. The table indexes and is adjustable transversely, which enables the four cylinder bores to be brought in line with the grinding wheel. This insures that both cylinders on each side of the casting will be in alignment. The cylinders on the steam side of the unit shown on the machine are 14 and 8 1/2 inches in diameter, and on the air side, 13 1/8 and 8 1/4 inches. These dimensions must be held to within plus or minus 0.001 inch.

In setting up a job, an indicator is applied at the right-hand end of the table to insure accurate alignment of one cylinder at that end with the center of the wheel-head. Then the opposite

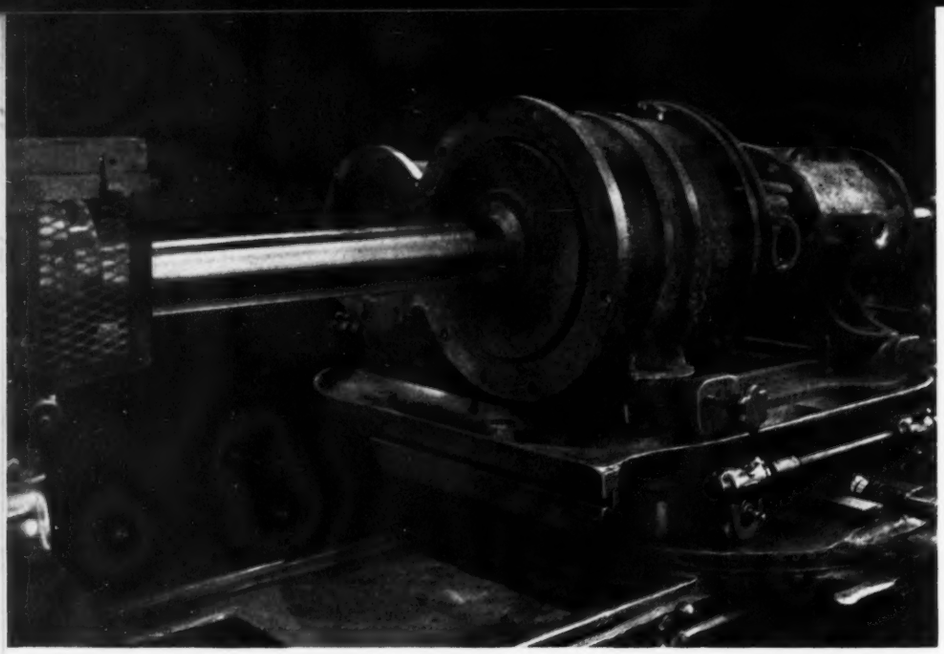


Fig. 15. Grinding Large Bore in a Cross-compound Air-pump Cylinder on a Machine with Provision for Obtaining Accurate Alignment of Each Pair of Cylinders

cylinder at the end next to the grinding wheel is checked by means of an indicator attached to the wheel spindle, which is applied around the chalked cylinder walls.

Guide bolts are being turned out at high production rates by a Jones & Lamson turret lathe in the operation shown in Fig. 17. Hexagon stock measuring 1 5/8 inches across flats is used for these bolts. The length of the bolt under the head is 9 inches, and the thread is cut for a length of 4 inches. The thread is 1 3/8 inches in diameter, six threads per inch. A bolt is produced every 1 1/2 minutes.

All cuts are taken by tools mounted on the hexagon turret. The first cut consists of chamfering the end of the bar to facilitate the start of the turning cut and give a finish to the end of the bolt. Then, after the turret has been indexed, the bolt is turned to the required diameter in one cut by a roller back-rest turner equipped with a Rexalloy cutter. One of the die-heads is then employed to cut the thread.

Four die-heads are mounted on the turret, so that the machine can be readily applied to cutting threads of different sizes. For example, frame and expansion sheet bolts are also produced by this machine without the necessity of providing other tooling. For turning taper bolts, a sine bar is mounted at the back of the turret lathe in the manner illustrated. The sine bar automatically adjusts the rollers and cutter of the roller back-rest turner radially outward to suit the changing diameter of the bolt as the turner feeds along the bed.

Many hand- and drop-forging operations of former days have been replaced by machine forging. For example, in Fig. 16 is shown a 7-inch Ajax forging machine being used for punching an elongated hole through one end of a spring plank hanger for passenger cars. The hole is 4 1/2 inches long by 3 inches wide, and is punched through 2 inches of solid metal. The same machine is used for upsetting the yoke end of the hanger previous to the punching opera-

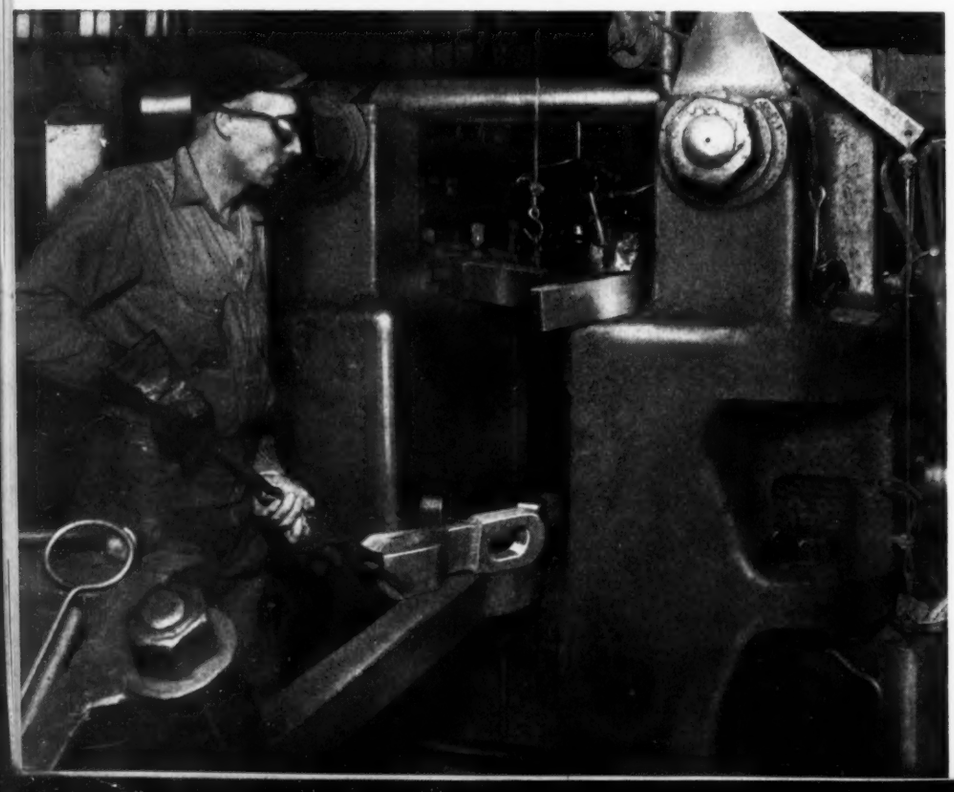


Fig. 16. Punching an Elongated Hole through a Spring Plank Hanger on a 7-inch Forging Machine

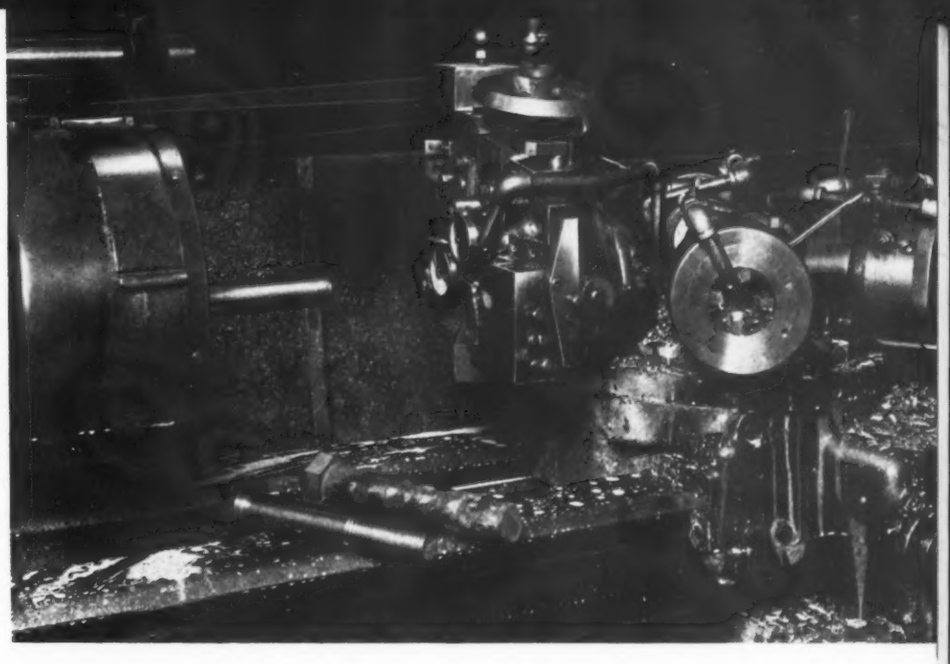


Fig. 17. Turret Lathe with Taper-bolt Turning Attachment Set up for the High-speed Production of Guide Bolts and Other Bolts, Both Straight and Tapered

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tion. This forging is made of two identical pieces of steel plate which are heated to a welding temperature and then fused together. In upsetting the yoke end, the original plates are separated to form the opposite sides of the yoke. The yoke measures 4 1/4 inches across.

In addition to forging the spring plank hangers, this machine is used for forging wrist-pin nuts, large spring bands, crankpin collars, brake staffs for freight cars, coupler pocket bushings, and so on.

A 3-inch National forging machine is shown in Fig. 18 upsetting a yoke on the end of heated round bars to form connecting-rods for car brakes. After the part has been reheated, a similar yoke is forged on the opposite end. The same machine is used for forging coach and tender brake beams, superheater unit bolts, 2 3/4- and 3-inch hexagon-head bolts, spring bands, spring and brake rigging pins of all types, etc.

Special tooling and machines designed specifically to meet problems of the railroad shop will be described in the remainder of this article. Fig. 19 shows an adjustable jig devised for use in boring the two ends of side-rods within close limits as regards center-to-center distances. This jig, which is built up on an old lathe bed, is used in conjunction with a radial drilling machine. The crankpin bearing in one end of the side-rod is gripped by the jaws of a chuck on a base attached near the left-hand end of the lathe bed. The chuck jaws are clamped against either the inside of the bearing or the external surface of the crankpin bushing that extends below the side-rod. The crankpin bearing on the opposite end of the side-rod is supported on a movable carriage. This carriage is locked in various positions along the lathe bed to suit the center-to-center distance between the crankpin bearings of different side-rods by a taper pin which enters dowel-holes in the bed. Graduations facilitate the different settings.

The movable carriage is provided with a

Fig. 18. Forging Yokes on Both Ends of Connecting-rods for Car Brakes in a 3-inch Forging Machine

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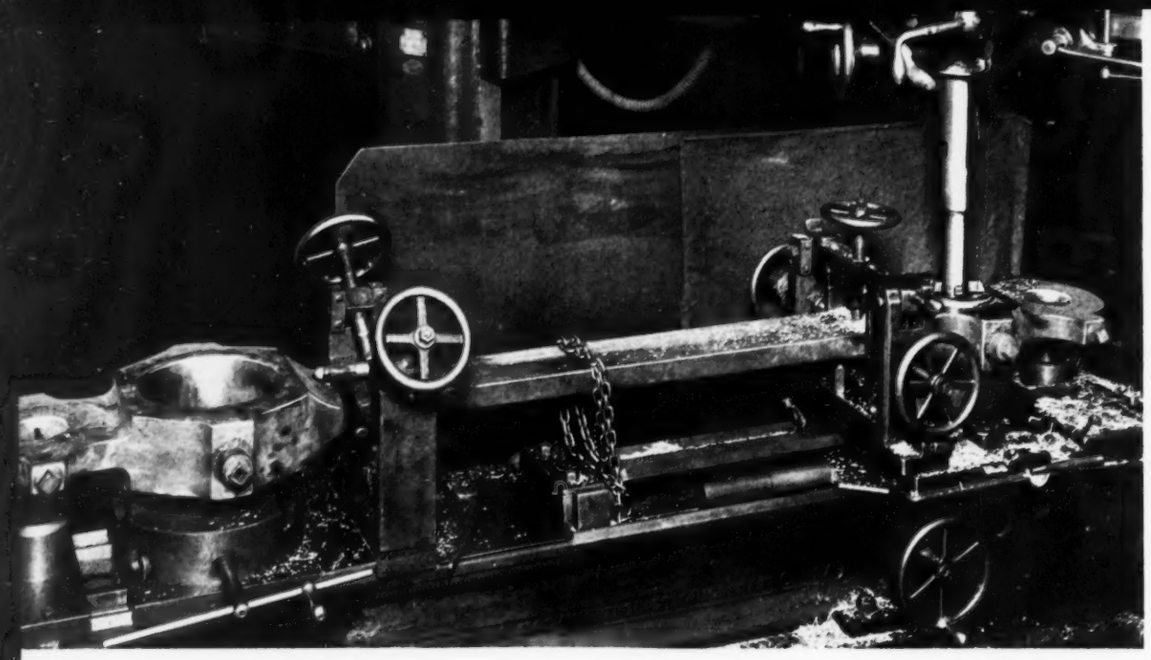

Fig. 19. Fixture that Facilitates the Boring and Reaming of Locomotive Side-rods within Close Center-to-center Distances

Fig. 20. Ingenious Fixture that Enables Different-sized Lobes on Multiple-throttle Camshafts to be Ground Accurately in One Setting

screw jack which is raised and lowered by means of a spanner wrench to make the side-rod level. The side-rod is then securely clamped adjacent to each crankpin bearing in two supports, one of which is bolted to the bed and the other to the movable carriage. The screw jack is provided with a bushing for piloting the boring-bar, which is used both in setting up the right-hand end of the side-rod on the carriage and also in boring the bearing in this end. Likewise, there is a bushing in the chuck at the opposite end of the lathe bed for guiding the boring-bar in machining the crankpin bearing at the left-hand end of the side-rod.

The knuckle-pin holes are also bored in the same set-up to accurate center distances. In boring these holes, the boring-bar is piloted by bushings held on saddles that are adjustable with respect to the centers of the chuck and screw jack which support the ends of the side-rods. Reaming, as well as boring, is facilitated by the use of this equipment.

The same jig is employed in boring and reaming side-rods of the fork-end type. It is checked every month to insure the required accuracy between the center of the chuck on the left-hand end of the bed and the center of the pilot bushing in the screw jack for all settings of the movable carriage.

In Fig. 20 is shown a fixture designed to facilitate grinding of the lobes on the camshafts of multiple throttles. It is being used on a Diamond surface grinder. The particular camshaft being ground has six pairs of lobes. The bottom side of each lobe is in a line parallel with the center of the camshaft, but the lobes increase progressively in width from one end of the camshaft to the other. The lobes of each pair, however, are identical in width.

In setting the fixture for grinding any pair of lobes, a small crank-handle is applied to the square-end shaft seen extending up from the right-hand end of the fixture. This shaft is provided with a worm which engages a worm-wheel

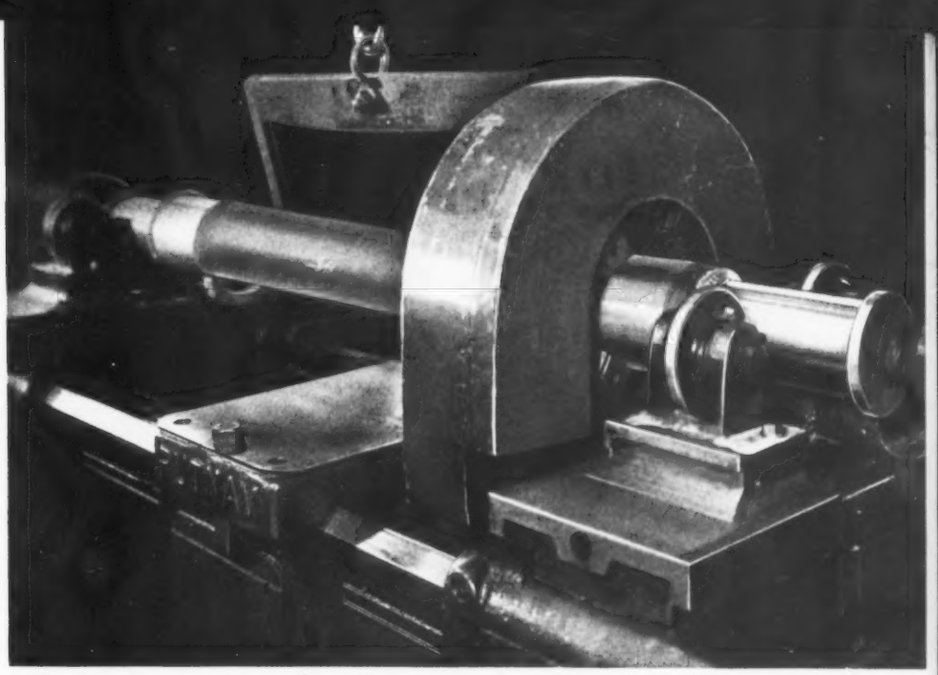

Fig. 21. Special Equipment Devised for Burnishing Both Journals of Car-truck Axles at the Same Time

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segment by means of which the entire fixture, with the exception of the base, can be revolved in respect to the camshaft. The worm-shaft handle is turned until a pointer on the stationary base registers with a graduation on the worm-wheel segment that corresponds with the thickness of the lobes to be ground. In other words, if the lobes are 7/8 inch wide, the segment is rotated until the 7/8-inch graduation coincides with the pointer.

Next, the height gage seen at the right-hand end of the table is set to a graduation corresponding with the width of the lobes to be ground. This gage is then placed at the back of the fixture, so that one of the lobes can be seated on top of the vertical gage slide. In this way, the bottom of the lobes is located properly with respect to the fixture. Clamps are then tightened to hold the camshaft and fixture in this relation as the cam lobes are rocked back and forth under the grinding wheel with the reciprocation of the table. Swiveling of the fixture and the work is accomplished by turning the fixture worm-shaft. All the lobes are ground on one side after making the required adjustment for each pair, and then the camshaft is turned end for end in the fixture for grinding the other side.

The journals of truck axles are burnished in order to compress the surface metal and remove all tool marks that might develop into fractures in service. To enable this operation to be performed quickly, the special equipment shown in Fig. 21 was provided on an old lathe bed. Carriages were supplied at both ends of the bed, and each of these was fitted with two cross-slides. A burnishing roller 7 1/2 inches in diameter is mounted on each cross-slide, so that both the journals can be burnished simultaneously. The cross-slides of each pair are actuated by right- and left-hand threads on the corresponding lead-screw. The rollers are positioned at an angle of 10 degrees with respect to the work, so that they feed themselves along the journals. The full length of the journals is burnished, and the fillets as well. These burnishing rollers are made of Stellite.

Salvage of Materials in Small Plants

THE idea that salvage programs are effective in large plants but are not practical in small ones is erroneous, according to Ray Schmidt, supervisor of the reclamation and salvage departments of the Westinghouse Electric & Mfg. Co. Whether a plant is large or small, there are likely to be many opportunities for salvage that were overlooked in the past, but that we cannot afford to overlook any longer. The scrap being salvaged should be carefully separated according to kind of material. Ferrous and nonferrous metals should not be mixed. Nickel-bearing alloy-steel chips, for example, should be kept separate from tool-steel chips. If they are, the scrap metal will bring a higher price, and, at the same time, will be more readily available for future use. Manufacturing executives must no longer argue that their main job is to get out production and that there is no time to bother with scrap, because, in the present emergency, scrap is a valuable commodity, just as is the finished product.

The designer also has an important responsibility for the economical use of materials. He must use standard sizes, and plan the design so as to avoid unnecessary scrap. Also, he should avoid using scarce materials whenever possible to do so and still meet the requirements.

Weather Control Helps Speed Airplane Production

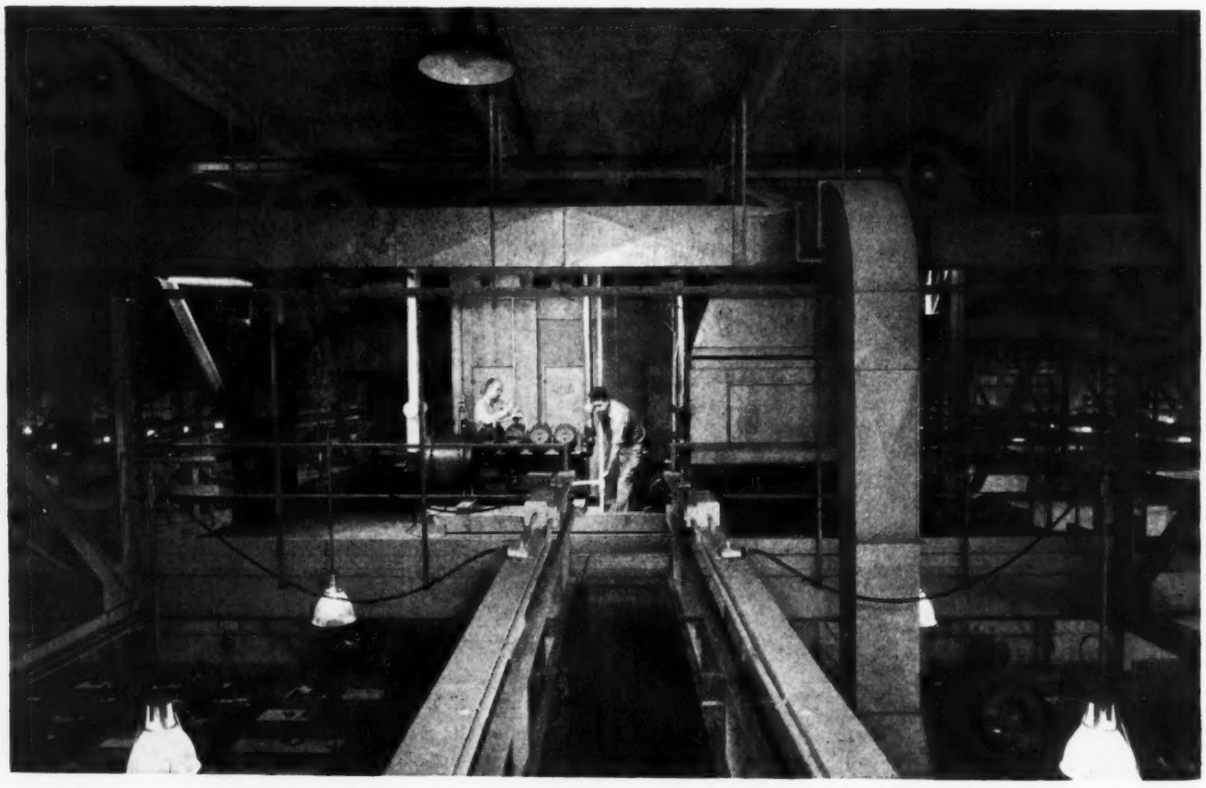
Approved for Publication by the War Department

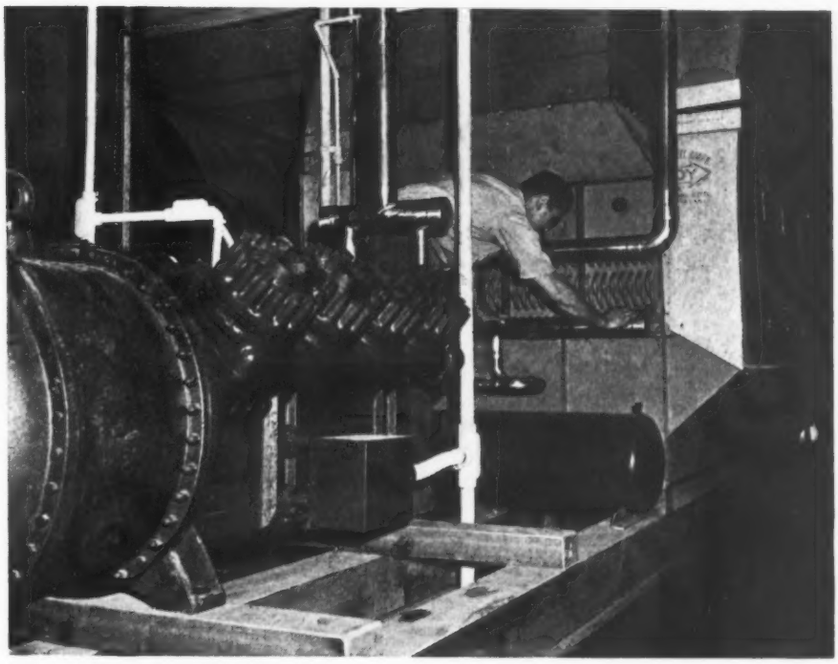
IN the Douglas Aircraft Co.'s huge new blackout plant on the Pacific Coast, the largest air-conditioning system west of the Rocky Mountains has been installed at a cost of more than $1,000,000. In the original buildings, which now are being expanded, this installation is so extensive that the duct work alone required nearly 2,000,000 pounds of sheet metal, while the refrigerating machinery has a cooling capacity equivalent to that produced by the melting of a 55-foot cube of ice every twenty-four hours.

The system is designed to maintain temperature and humidity at efficient and comfortable levels. The manufacturing departments are cooled to 80 degrees F. dry bulb and 48 per cent relative humidity, and the offices to 78 degrees F. dry bulb and 50 per cent relative humidity.

Every consideration has been given to making this plant as secure from bomb damage as possible. Since it has no windows or skylights, the ventilation, heating, cooling, maintenance of humidity, and removal of smoke and dirt must all be provided by the air-conditioning system. Thus, it will be apparent that the air-conditioning system is a vital factor in the operation of the plant. In line with other precautions taken, a system of many individual air-conditioning units was installed instead of one central heating and cooling plant, which, if damaged, would affect the entire factory. Each of these units, designed to condition the air of a definite zone, has a cooling capacity equivalent to that produced by melting 60 tons of ice each twenty-four hours, and has its own condenser unit,

Decentralized Air-conditioning Units Located on Overhead Platforms Built in the Roof Trusses are Interconnected by 3-foot Catwalks, which Give Access to Lights and Traveling Cranes as Well





Condenser, in Foreground, and Cooling Coils, in Air Duct, Form One of the Many Units of the Air-conditioning System Installed in the Douglas Plant

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compressor, cooling coils, steam heating coils, fan, filters, and duct system.

All buildings are provided with from two to fifteen refrigerating and fan units, except a raw stock and storage structure which requires only ventilation. Two or more independent boiler plants are provided to heat each of the main buildings. The air-conditioning equipment utilizes Freon direct expansion units supplied by the Westinghouse Electric & Mfg. Co. and the York Ice Machinery Corporation. The heating system employs low-pressure steam equipment with Kewanee gas burning boilers.

Overhead installation is a feature of the air-conditioning equipment. In the production, receiving, and storage buildings, the fan stations are installed on platforms 20 by 25 feet in size, which, in the various buildings, range from 22 to 35 feet above floor level. Air expulsion is through adjustable directional-flow grilles in the ducts directly below these platforms. Air supply outlets are provided in each bay. Return ducts are installed with drops at the columns along the outside walls to within 6 feet of the floor, providing proper air circulation at working levels. Each fan station is able to handle in

Huge Ducts Wrapped with Insulating Material Carry More than 3,470,000,000 Cubic Feet of Air throughout the Plant Buildings Each Day

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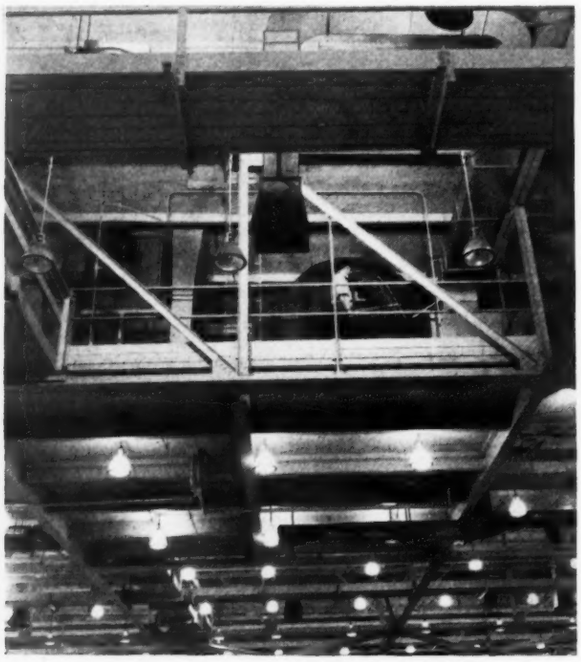


Another View of Overhead Platform Supporting Complete Air-conditioning Unit. An Air Duct Vent is Seen in Front of the Platform

One of the Ceiling Outlets of the Air-conditioning System which is Installed in the Offices and Cafeteria of the Douglas Plant

this manner some 36,000 cubic feet of cooled or heated air per minute.

Every twenty-four hours the supply, exhaust, and recirculating fans of the air-conditioning system handle more than 3,470,000,000 cubic feet of air. To drive the ventilating and cooling equipment, electric power equivalent to approximately 5700 H.P. is utilized, or enough to operate 34,000 average-size household refrigerators. Automatic control is provided by thermostatic instruments, set to precisely maintain the desired conditions of temperature and humidity.

Servicing of the overhead units, as well as lights and traveling cranes, is simplified by a system of connecting 3-foot catwalks, protected by guard rails, to which access is available through hatches in the roof. Service men can move from one platform to another in a building without descending to the floor.

In the administration and other non-manufacturing buildings, conditioning units and heating coils are installed above the ceilings, the air being expelled through Venturi-Flo outlets mounted in the ceiling.

Decentralization has also been extended to the heating system, which consists of twenty-two individual steam boiler rooms, providing a total of 236,320 square feet of direct radiation.

In its operation, the air-conditioning system of the Douglas plant has already shown extensive and significant results by enhancing employe morale, reducing the number of industrial accidents, and decreasing the non-industrial illness—all of which bear directly on the speed and success of the war production drive for air superiority.

* * *

The Automotive Industry in War Production

The Automotive Council for War Production, New Center Bldg., Detroit, Mich., has compiled and published a booklet entitled "The Job is Being Done," giving a concise record of what is being accomplished by the automotive industry in war production. The part played by the industry surpasses all expectations. Not only is the output greater than expected and many deliveries far ahead of schedule, but the ingenuity of automotive engineers has saved the Government both time and huge sums in reduced costs.

The Division of Industry Operations of the War Production Board in a recent release gives specific figures on this subject. War shipments by the automotive industry were 46 per cent greater in April, the last month for which complete statistics are available, than in February. This figure is based on reports from 432 plants of 157 companies employing 72 per cent of the labor in the industry. It includes the plants of 8 large automobile manufacturers, 9 truck companies, and 140 parts companies. The 432 plants referred to employed 561,480 men and women in April.

Engineering News Flashes

Portable Million-Volt X-Ray Units Available for Industrial Use

According to W. F. Westendorp, of the X-Ray Division of the General Electric Research Laboratory, more than forty portable 1,000,000-volt X-ray units are now in actual operation in industrial plants throughout the country, where various products, including turbines, crankshafts, etc., are being made. A year ago, only one such unit was in industrial use.

This equipment is made portable because some of the large forgings and castings that are examined weigh many tons, and it would be extremely difficult to move them for making X-ray photographs with equipment installed in a fixed position; consequently, portable units, completely enclosed in a metal tank 3 feet in diameter by 4 feet in length, and weighing 1500 pounds, have been developed.

Simple Method of Marking Cylindrical Parts

A new motor-driven machine has been developed by the Acromark Corporation, Elizabeth, N. J., for marking cylindrical parts—such as collars, rings, flanges, couplings, ferrules, etc.—with a permanent ink marking. The part to be marked is placed on a protruding mandrel by hand, and a rotating die prints the mark, after which the part is ejected automatically. The ink used is a liquid dye with an acid content, and the marking is permanent, not subject to weather conditions, handling, salt water, gasoline, and oil. The action of the small amount of acid contained in the ink is quickly exhausted after a slight etching, leaving a permanent and clear marking. The ink does not injure the surface of the metal nor is it dangerous to use.

Electronic Separator Concentrates Metallic Ore

To concentrate the metallic ore containing tin and other war metals from low-grade deposits, an experimental electronic ore separator has been developed at the Westinghouse Research Laboratory, which extracts the ore suitable for smelting. This device has recently been demonstrated before a group of metallurgical experts, including representatives of the United States Bureau of Mines.

If this separator is as efficient in actual mining operations as in laboratory tests, it can be a valuable aid in easing America's tin shortage. The most promising results with this new separator have been attained with low-grade ore samples from a recently developed tin deposit in a southern state. This sample deposit, containing 1 per cent tin, when separated by this device, yielded a concentration of metallic ore containing about 70 per cent tin. The foot-wide metal drum of the laboratory separator, turning at a surface speed of 12 miles an hour, sorted in one minute the 10,000,000 particles making 10 pounds of ore. Two piles of particles were deposited—one contained rock and sand and a small percentage of tin; the other, nearly all tin, with a small amount of rock and sand.

Huge Water-Wheel Generators for Grand Coulee Dam

Work has been started on three additional 108,000-kilowatt water-wheel generators for the Grand Coulee Dam to produce power for aluminum plants in the Pacific Northwest. This brings to nine the number of these water-wheel generators—the largest in the world—which Westinghouse has contracted to build for the Grand Coulee Dam. Three of these machines already have been completed and installed; three have been under construction since last August.

Each 24-foot high generator is 45 feet in diameter and consists of 1000 tons of parts, requiring thirty-eight freight cars for shipment from the Westinghouse East Pittsburgh works to the dam. The heaviest parts are the steel frame; the spider—a single piece of steel, weighing 75 tons, used to support the rotating mechanism on the shaft; and a 74-foot steel shaft, which weighs 153 tons. Because of its great length, this shaft is made in three parts which are bolted together.

Ultimately, the Grand Coulee Dam will have eighteen of these 108,000-kilowatt water-wheel generators, making it the largest single source of power in the world. After the war, some of the electricity will be used eventually to pump water into the vast, semi-arid Big Bend area, 50 to 125 miles southwest of the dam. There the water will restore productivity to about 1,200,000 acres deprived by the Cascade Mountains of the moisture-bearing winds from the Pacific Ocean.

EDITORIAL COMMENT

Concurrent with their effort to obtain the maximum possible production in their plants so that the war may be terminated as soon as possible by an Allied Victory, many manufacturers are beginning to give thought to the after-the-war period. "What," they ask, "will these tremendous manufacturing plants do after the war?" Some answer this question with confidence in America and all that America stands for; others express doubt, because they feel that the United States has practically reached the peak of industrial advance.

"There is no hope for any great increase in industrial development," they say, "or for the employment of a large number of workers in the manufacturing industries. In the past, all industrial expansion took place when there was some great invention or development to be exploited. There was the era of railroad building; there was the bicycle manufacturing boom; there was the automobile and the radio. But what is there now? When the war is over and we return to peaceful pursuits, what shall we manufacture?"

Have We Reached the Limit of Our Industrial Development?

What is there now! Have we reached the end of our industrial development? Have we come to the point where everybody has all the conveniences and comforts in life that would satisfy reasonable demands? Have human needs been so completely met that there is no further call for the employment of human labor in satisfying the wants of the millions of people in this and other countries?

Men who talk in such terms speak and act as if every home throughout the land were equipped with reasonable sanitary facilities; with good artificial lighting; with automatic refrigeration; with proper means of heating; not to speak of air-conditioning, which, in time, will become one of the great industries of the United States. Today, there is a radio in almost every home, and in many homes there are several. How do we know that ten years from now there will not be a television set for every radio of today?

There are more than 25,000,000 automobiles in this country, and every one of them is getting older every day. During the war, millions of these cars will become unfit for further use and must be replaced. The replacement market will be far greater than was the market due to new purchases at any time in the past.

Industry has a Big Job Ahead to Meet Tomorrow's Needs

The railroads have embarked on a new era. Lightweight trains that can be run more safely at higher speeds than could the old heavy trains at lower speeds will be introduced not as mere novelties on a few roads, but as the general means of railroad transportation.

And then there is the airplane. Who can foretell whether the present developments in that field, making landings on a limited area possible, will not make the airplane a formidable competitor of the automobile? What unlimited manufacturing possibilities that idea opens up!

And yet there are those who wonder what the future has to offer to manufacturing enterprise. We need assurance on one point only — that American free enterprise will have the same opportunity to raise the standard of living of the nation that it has had in the past. American initiative and enterprise will take care of the rest.

The importance of salvaging rubber, aluminum, and scrap iron has been thoroughly emphasized through the drives that have been inaugurated, but there are a great many other materials the salvage of which is highly important. Outstanding among these are copper, nickel, and tin. In addition to salvaging these metals, care must be taken to keep down scrap losses in manufacturing operations. Formerly, the scrap losses were significant only as an item of manufacturing cost. Today, reduction of scrap losses and salvaging operations are important from the point of view of conserving our stock of at least half a dozen scarce metals.

Salvaging of Waste Materials Is Now a National Service

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Adjusting Throw or Radial Position of Block on Rotating Arm

The mechanism here described was designed to permit a very fine, continuous adjustment of block *A*, Fig. 1, along radial arm *B* while the arm is rotating about axis *X–X*. The arrangement of the mechanism, as adopted, is shown diagrammatically in Fig. 2, while an alternative arrangement (considered, but not adopted) is shown in Fig. 3.

Screw *C* is used to move the block, and is, in turn, driven by shaft *D* through bevel gears. Shaft *D* carries one wheel of differential *E*, the other wheel of which is driven by a train of gears from wheel *G*, which is fixed to arm *B*. The intermediate shaft rotates about a fixed axis *P–P*.

The ratio of the gear train beginning with driver *G* and ending with driven gear *F* is unity, and because of the reverse idler, gears *F* and *G* rotate in opposite directions. Thus, when the housing of the differential is stationary, shaft *D* rotates in the same direction and at the same speed as arm *B*, and the position of block *A* on the arm is fixed. If, however, the differential housing is rotated, then its motion is added to, or subtracted from, that of shaft *D*, which, consequently, rotates relative to arm *B* and thus moves block *A* inward or outward. The block is, therefore, controlled by the worm and wheel drive to the differential housing. The drive to the mechanism and to arm *B* is through gear *G*.

In the alternative arrangement, shown in Fig. 3, the ratio of the epicyclic train *F* to *G* must be 1 to 2, in order that the differential housing may be rotated in the same direction as, but at half the speed of arm *B*. This requires the number of teeth in *G*, multiplied by the number of teeth in *K*, divided by the number of teeth in *L*, times the number of teeth in *F* to be equivalent to the ratio 1 to 2, and also necessitates the use of intermediate wheel *H*.

When shaft *M* is stationary, the rotation of the differential housing *E* causes shaft *D* to rotate in the same direction and at double the speed, so that it rotates in synchronism with arm *B*, and block *A* thus remains in a fixed position. When shaft *M* is rotated, the motion is transmitted to screw *C* and the block is moved. This arrangement, however, was not adopted because the drive to the arm was more difficult to arrange.

B. M.

Mechanism for Feeding Washer-Shaped Blanks to Die with Concave Sides Up

Washer-shaped blanks of slightly concave form, as indicated at *a* in the accompanying illustration, are fed by gravity from a hopper through a chute *L* to the mechanism to be de-

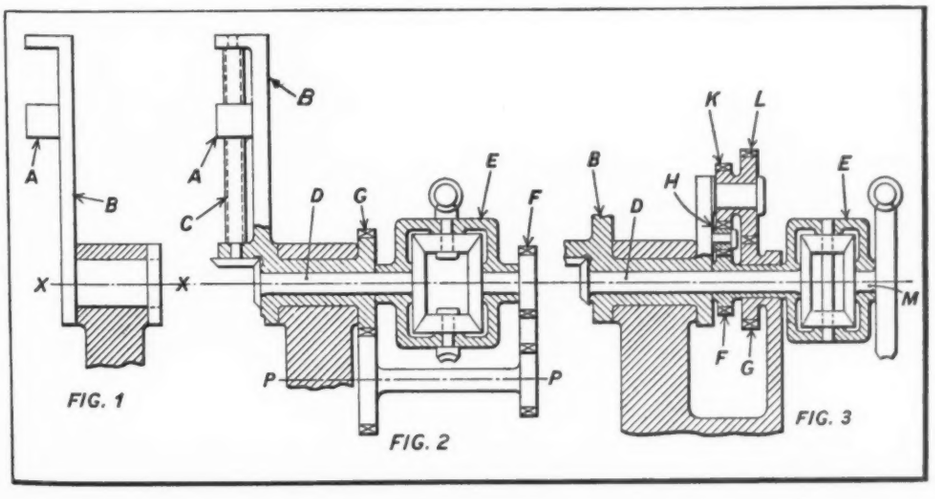


Fig. 1. Section of Mechanism that is Required to Have the Throw of Block A Adjusted while Arm B is Rotating

Fig. 2. Sectional View of Mechanism Designed for Adjusting Throw of Block A

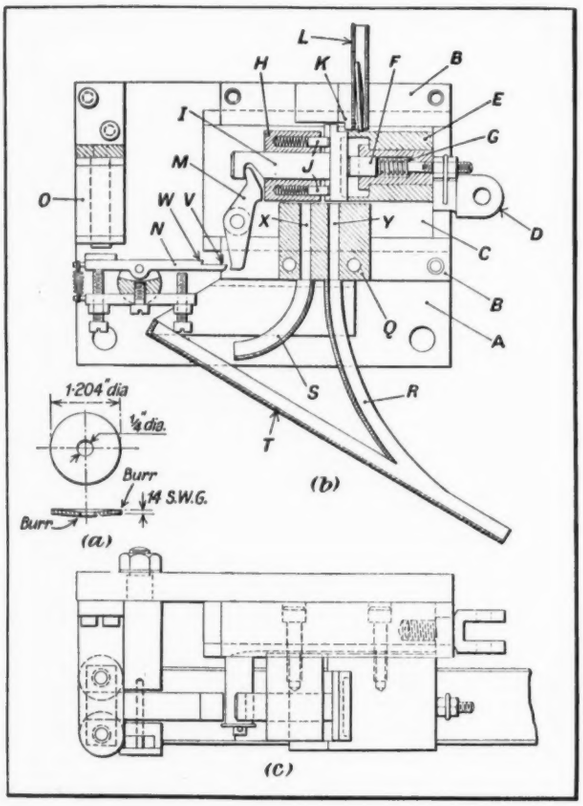
Fig. 3. Sectional View of Alternative Throw-adjusting Arrangement

scribed. The mechanism, in turn, automatically feeds the blanks, one at a time and concave side up, through chute *T* to the die of a punch press.

The part *a* is produced by piercing and blanking from mild strip steel. This operation leaves slight shearing burrs around the edge of the blank, as indicated, and gives it a concave or dished effect that varies from 0.010 to 0.040 inch. It is the function of the mechanism shown at *b* and *c* to insure feeding the blanks to the die through chute *T* with the concave side up toward the forming punch.

Referring to sectional side view *b*, baseplate *A* carries guides *B*, in which the sliding piece *C* is moved horizontally by the pin joint *D*. The pin joint is operated through a linkage connected to the press connecting-rod. A friction slipping device is incorporated to enable the sliding piece to be stopped at certain positions during the cycle. The contact body *E* is fixed to the sliding piece and is bored out, as shown, to receive an insulating bushing which carries the spring contact plunger *F*, this being adjusted to bring the end face level with the face of the contact body, where it is held by spring *G*.

Block *H* is also fixed to the sliding piece and carries the movable clamp *I*, which is forced toward the contact body by two spring pegs *J*.



(a) Views of Blank, Showing Distortion and Burrs. (b) Sectional Side View of Selecting Device. (c) Plan View, with the Chute L and Stop K Removed

The upper side of the clamping head is milled to form a stop, so that when the slide is moved to the right, the clamp is arrested by a fixed stop *K* and the slide is brought to rest when block *H* comes up against the back of the clamping head.

In this position, a blank in chute *L* may fall into the gap between the contact body and the clamping head. A notch is milled in the clamp stem to engage the upper end of the lever *M* as shown, the lever being freely pivoted on a stud screwed into the sliding piece. The free end of the lever may engage either of the stops *V* or *W* when the sliding piece is moved to the left. The stop engaged depends on whether pivoted stop *N* is up or down, the position of *N* being controlled by an electromagnet *O* connected in series with the contact body *E* and a suitable source of direct current.

The two positions in which the clamp may be withdrawn and the blank released are indicated by the delivery slots *X* and *Y* in block *Q*. The arrangement of chutes *R* and *S* is such that a blank sliding down chute *R* will be turned 60 degrees in an anti-clockwise direction, and a blank sliding down chute *S* will be turned 120 degrees in a clockwise direction before passing down chute *T* to the press tool and its feeding mechanism.

Assuming that a blank is in chute *L* as shown, and that slide *C* is moving to the right, the action of the device is as follows: Clamp *I* is arrested by stop *K*, and the contact body *E* moves on, allowing the blank to fall into the opening produced. The slide is then moved to the left, permitting pegs *J* to clamp the blank against the contact body, which results in the electromagnet *O* being energized. Stop *V* is moved out of the path of lever *M*, and the blank is carried along until lever *M* comes in contact with stop *W*, when the clamp is withdrawn and the blank is discharged down slot *X*. As soon as the blank leaves the contact face, the circuit is broken and the magnet de-energized, so that, on the return of the slide to the starting point, the stop *N* returns to its original position when cleared by lever *M*.

If the blank is located in chute *L* the opposite way round to that shown, then the central part of the disk will not touch the contact plunger and the magnet will not be energized; consequently, stop *V* will cause the blank to be discharged down slot *Y*. It will be apparent, therefore, that all blanks sliding down chute *T* will be hollow side up as required.

* * *

In these days when, by necessity, Government must direct many things, don't forget that "the government that governs least governs best."

Selecting Oven Type Heat-Treating Furnaces

Characteristic Features of Gas and Electric Oven Type Furnaces Used for Heat-Treating Tool Steels and for Various Other Heat-Treating Operations—Last of a Series of Four Articles

By
HOLBROOK L. HORTON

Sentry Small Pedestal Oven Type Electric Furnace for Hardening High-speed Steel Tools. Air-cooled Terminals are Visible at Sides

WHERE there is a considerable volume of heat-treating to be done, furnaces of ample capacity are desirable. While this article does not attempt to cover the large oven types of furnaces, some of the medium sizes of gas furnaces were described in a previous installment, and electric furnaces of a similar type are discussed here.

A series of box or oven type furnaces built to handle a considerable volume of work have ribbon type heating units located on all four sides of the heating chamber and supported in refractory slots. These heating elements have a heavy cross-section at the terminals, so that they will remain as cool as possible, reducing terminal heat losses and burnouts where the terminals pass through the rear furnace wall. Furnaces of this type have a temperature range ordinarily extending up to 1850 degrees F.; but for certain applications, they may be used up to 2100 degrees F. The door overlaps the opening on all sides, and is sand-sealed at the bottom. A foot-treadle door-opening arrangement is used on the small sizes, and a counterweighted chain hoist on the larger sizes.

These furnaces have a one-piece chromium-nickel alloy floor plate, which gives a continuous hearth surface and affords complete protection for the floor units. They range in size from that having a heating chamber 17 inches long by 12 inches high by 8 3/4 inches wide to that having a heating chamber 70 inches long by 28 inches wide by 29 inches high. The smallest of these furnaces has a rating of 13 kilowatts, and takes approximately 1 1/4 hours to reach a temperature of 1500 degrees F. The largest has a rating of 85 kilowatts, and takes approximately 3 hours to reach a temperature of 1500 degrees F. They operate at 220 volts.

Furnaces for Low-Temperature Heat-Treating on Production Basis

Another type of furnace designed for production hardening, tempering, annealing, and carburizing is somewhat similar in design to a smaller furnace used for job lots. It consists of a heavy steel shell, supported on angle-iron legs, with a cast front to give rigidity and prevent warping. In the two smallest sizes, chromium-rod heating elements are located on the roof and sides of the heating chamber. Refractory guides keep the turns of the elements separated and prevent accidental short circuits. The side heating elements are protected by perforated porcelain muffles.

On the larger sizes of these furnaces, heating elements are placed only on the side walls and under the bottom of the floor plate. Flanged removable alloy hearth plates form the bottom of the heating chamber and protect the heating

elements below from damage. The door is counterbalanced, and peep-holes are provided for inspection of the chamber when the furnace is under heat. Adjustable clamps are furnished to insure a tight fit when the door is closed. Accidental overheating, with resultant damage, is prevented by the use of a temperature limit fuse.

These furnaces range in size from that with a door opening 11 3/4 inches wide by 8 inches high and a heating chamber 27 1/4 inches long to that with a door opening 32 1/4 inches wide by 23 1/2 inches high and a heating chamber 81 1/2 inches long. The smallest size has a connected capacity rating of 12 kilowatts, and the largest 70 kilowatts.

Work Chamber Completely Surrounded by Heating Elements

In another line of box type furnaces designed for production use, the furnace shell is built of heavy steel plate, reinforced with structural steel members, which are electrically welded together to form a rigid structure. Angle-iron legs or structural I-beams are used for support. The furnace door is of heavy ribbed steel, enclosing two or more courses of heat-insulating material. Adjustable counterweights provide exact balancing of the door and hold it stationary in any position.

A laminated wall of high-, medium-, and low-temperature material is used for insulation purposes. Chromium-nickel alloy rod is used for the heating elements, and these are located on both sides, top, bottom, rear wall, and door of the furnace. This distribution of elements renders the entire hearth an effective working area, and supplies a substantially greater loading capacity than if no heating elements were used on the rear wall and door. Automatic temperature control equipment is supplied with the furnace, and an excess temperature cut-out protects the charge, as well as the furnace, from damage.

These furnaces have a maximum operating temperature of 2000 degrees F. They are available in sizes ranging from that with an effective chamber size 6 inches wide, 12 inches long, and 5 inches high to that with an effective chamber 36 inches wide by 84 inches long by 20 inches high. The smallest has a rating of 4.5 kilowatts, and the largest 105 kilowatts. The two smallest sizes are bench type furnaces and operate at low voltage, requiring transformers for connection to the power line; the other sizes operate at 230 volts.

Use of Fan in Heating Chamber

An interesting design of box type furnace utilizes a centrifugal fan within the heating chamber to secure a high degree of uniformity in heating over a wide temperature range. While the forced movement of the atmosphere within the heating chamber is of particular value for operations below the range of red heat, it may also be utilized for achieving temperature uniformity throughout the full operating range of 400 to 1850 degrees F. Thus, these furnaces are widely adaptable for the drawing and tempering of steels, annealing of non-ferrous metals, brazing of aluminum, annealing of cast iron, hardening of steels, and annealing or normalizing of either rolled or cast steel.

One or more fans are used, depending upon

Hevi Duty Convection Type Electric Oven Furnace for Medium-temperature Duty. A Built-in Centrifugal Fan Provides Uniform Circulation of Heated Air over the Work

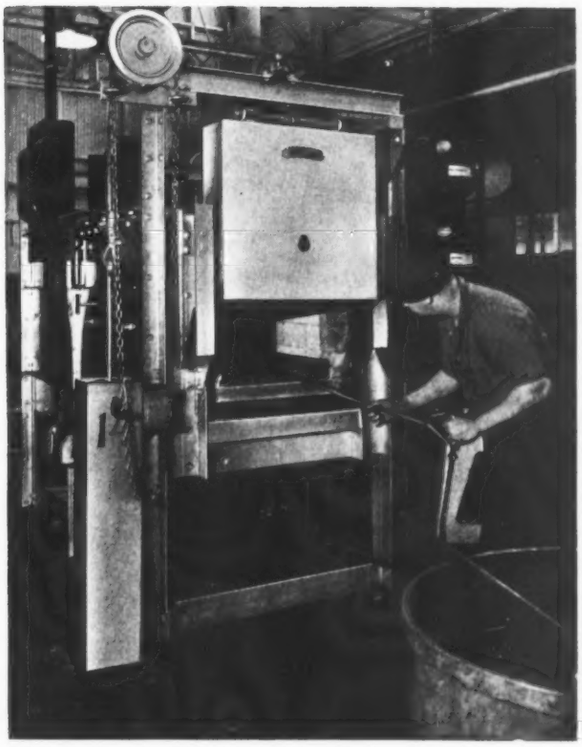
the size of the furnace, and these are removable for inspection, repair, or replacement. Return-bend, round-rod heating elements in radiant plates held by fluted T-supports are employed, and these may be exposed for direct radiation or located back of perforated plates. This type of furnace is available in sizes ranging from that with a heating chamber 12 inches wide by 24 inches long by 12 inches high, having a rating of 14 kilowatts, to that with a heating chamber 36 inches wide by 72 inches long by 20 inches high, having a rating of 95 kilowatts. All sizes operate at 230 volts.

Electric Oven Furnaces for Treating High-Speed Steel

Available for production heat-treating over a wide range of temperatures extending up to 2750 degrees F. is a series of six electric oven type furnaces. Although capable of continuous operation at this high temperature, they are also suitable for use at temperatures as low as 1200 degrees F. Heavy gray-iron castings are used for the front and back plates, and the dome and sides are of heavy steel plate. The door is located inside the furnace shell, and, when closed, is sealed by grooves at the top, bottom, and sides, thus forming a part of the insulated front wall equal in thickness to the other furnace walls. The smallest of these furnaces has a hand-operated counterbalanced door, and the other sizes have a foot-treadle operated counterbalanced door. A hydraulic door lift can be provided for the largest size.

The heating elements are rod-shaped and are located below and above the hearth. Water-cooled terminals are provided. An average heating period of about 1 1/2 hours is required to raise the temperature of the furnace chamber, when empty, from 50 to 2400 degrees F. The smallest size, built for bench mounting, has a furnace chamber which is 6 1/4 inches wide, 4 inches high, and 9 inches deep. Its maximum rating is 10 kilowatts. The same size furnace can also be obtained with a pedestal mounting for floor use. The largest size has a furnace chamber 24 inches wide, 12 inches high, and 36 inches deep, and has a maximum rating of 100 kilowatts. The depth of all of the furnaces in this series can be doubled at additional cost.

Designed especially for the heat-treating of high-speed steels is another series of three electric furnaces. This type is of rugged construction, with a steel shell suitably insulated for high-temperature operation up to 2500 degrees F. The heating elements are located above and below a silicon-carbide muffle chamber, which is removable. With reasonably new heating elements, the smaller sizes of these furnaces will heat from cold to 2350 degrees F. in less than an hour, and the largest size in about 1 1/4 hours. Air-cooled terminals are provided, and all electrical contacts are shielded.



Hoskins Electric Oven Type Furnace for Medium-temperature Heat-treating. Automatic Temperature Controller is Shown at Upper Right

These furnaces are designed to take holding blocks of carbonaceous material into which the high-speed steel tools are inserted for heating. When heated to about 2300 degrees F., the blocks produce a gaseous atmosphere, which is neutral in its effect upon the steel being hardened.

In the smallest size furnace, the muffle chamber is 4 1/2 inches wide, 2 inches high, and 9 inches deep. It has a maximum rating of 10 kilowatts for direct connection to a 110- or 220-volt line. The largest size furnace has a muffle chamber that is 8 7/8 inches wide by 4 inches high by 16 inches deep. Its maximum rating is 26 kilowatts for direct connection to a 220-volt line.

Furnaces for Vertical Hardening

A furnace designed to permit the hardening of long tools in a vertical position, so as to prevent warping or changing of shape during hardening operations, is available in two sizes. This type of furnace will operate satisfactorily at temperatures ranging up to 2500 degrees F. It has a removable silicon-carbide muffle chamber and a vertical lift door. Blocks of carbonaceous material for holding the tools to be treated and for producing the proper heat-treating atmosphere can be used with this furnace. Loose

bricks are supplied to close the muffle opening and to support the tool-holder.

The smaller size furnace has a muffle chamber 4 inches by 4 1/2 inches by 11 inches deep. Its normal operating power consumption is 4 to 10 kilowatts per hour, and it has a maximum rating of 16 kilowatts. The larger furnace has a muffle chamber 4 by 4 1/2 by 28 inches deep. Its normal operating power consumption is 8 to 20 kilowatts per hour, and its maximum rating is 32 kilowatts.

Another series of electric furnaces is designed for heat-treating at temperatures ranging up to 2300 degrees F. Alloy-wound heating elements included in the all-refractory material are located in the top, bottom, side walls, and rear of the heating chamber. Refractory muffles having one end closed are provided with the furnace. The heater plates can also be reversed to form a muffle.

In the smallest size, the muffle is 3 inches high, 4 1/4 inches wide, and 10 inches deep on the inside. This furnace has a rating of 2.5 kilowatts. In the largest size, the muffle is 7 inches high, 12 inches wide, and 26 inches deep. It has a rating of 24 kilowatts. These furnaces can be provided with manual or automatic temperature control.

Another series of four furnaces is suitable for practically any heat-treating operation requiring temperatures up to 2500 degrees F. The chamber lining consists of preformed high-temperature refractory backed with two layers of insulating brick and a third layer of block insulation. The hearth and baffle plates are bonded silicon carbide. A double overhead type of counterbalanced door lift is used. A hand-operated door lift is standard equipment, but air cylinder operation with a three-way foot-operated air valve is also available.

The heating elements are of the non-metallic pin type with air-cooled terminals. They are horizontally mounted above the furnace chamber and below the hearth to provide uniform temperature distribution. To increase the life of the elements, to offset their inherent rise in resistance, and to provide flexibility in the range of operating temperature, a tap transformer and a voltage change switch are used.

The sizes of these furnaces range from that with a heating chamber 8 inches wide by 12 inches long by 5 inches high, having a rating of 18 kilowatts, to that with a heating chamber 16 inches wide by 30 inches long by 12 inches high, having a rating of 52 kilowatts.

Large Electric Oven Type Furnace for Hardening, Tempering, Annealing, and Carburizing, Built by Westinghouse Electric & Mfg. Co.

* * *

Treasury Department's Payroll War Savings Plan

In order to promote the payroll savings plan, the United States Treasury Department has made available to business firms in the country a complete set of promotional material, designed to help business firms aid their employes in investing part of their income in war savings bonds.

Nearly 100,000 of the nation's business firms have already installed this plan for systematic purchase of war bonds by employes through voluntary pay deductions for that purpose. In most cases, the management of the company assumes the burden of the entire cost of administration and bookkeeping.

Among the material available to business firms for this purpose is a book entitled "A Plan for Diverting at Least 10 Per Cent of America's Payroll into U. S. War Bonds;" another booklet tells "How to Install and Successfully Operate a Payroll War Savings Plan for the Regular Purchase of U. S. War Savings Bonds." There are also books available for the employes explaining why the money saved by the workers is of vital importance in winning the war and how practical benefits also are secured by each worker through having a reserve fund built up for the post-war years.

To give each worker tangible evidence of his participation in this program, lapel buttons are furnished reading "I am buying at least 10 per cent." Window stickers with similar wording are provided for the war bond buyer's home.

Tooling Equipment in a Machine Tool Plant

Time-Saving Fixtures and Set-Ups Used in the Plant of the Delta Mfg. Co. for Speeding Machine Tool Production

THE machines and other products built by the Delta Mfg. Co., Milwaukee, Wis., are made in sufficiently large quantities to permit the use of efficient tooling. Some examples of the tooling equipment used are described in the following:

Rough iron castings which are to be faced in a surface grinder are held in the fixture shown in Fig. 1. The fixture has three C-shaped locating fingers, each having a screw that bears against the top face to be finished. These screws are so set that, when the work is in place, their ends, which are the locating points, are in a plane parallel with that of the grinding wheel face. Springs below the casting hold the latter against the locating points until side clamps are fastened to lock the casting in position. Then the locators are swung back out of the way, leaving the casting in such a position that only a minimum cut is required to finish the face. If the casting were located from below, variations in the surface relative to the locating points probably would necessitate much heavier cuts, with needless waste of time and greater wheel wear. The locating method used is both rapid and convenient.

In Figs. 2 and 3 is shown a fixture for milling the slots and edges of a circular-saw table after the top face (which is turned down in the illustrations) has been machined. It is necessary that the bottoms of the slots be parallel with the face, and that the edges, which are milled at the same time, be parallel with the slots and at right angles with the face. The work is clamped face down against a locating surface. In this position, chips made by the cutter fall away from the slots. The depth of the latter is readily held within the 0.001-inch tolerance specified.

Since all machines built by the company are so produced that the parts are interchangeable, it is necessary that center distances be accurately held and that holes be produced not only within

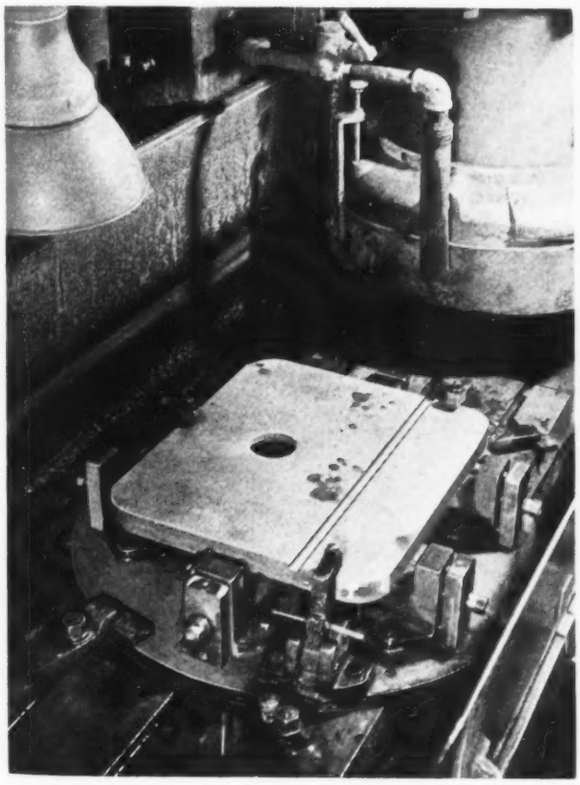


Fig. 1. (Left) Set-up for Surface Grinding, in which the Piece is Located against the Ends of Three Screws in a Plane Parallel to the Bed. After the Piece has been Fastened, the Locating Parts are Swung aside. Fig. 2. (Right) Fixture Used in Milling Slots and Edges of a Circular-saw Table

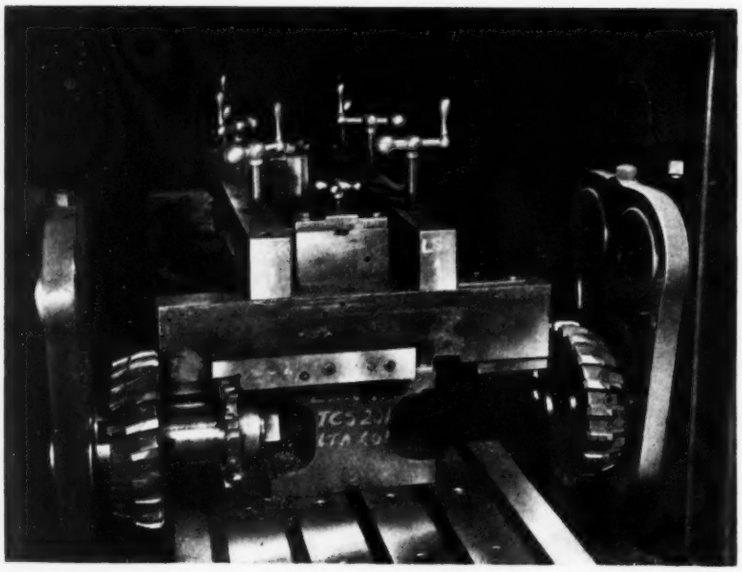


Fig. 3. Another View of the Fixture Shown in Fig. 2

close dimensional limits, but with their axes in correct relation to the bed or other locating surfaces. To facilitate some of the precision boring operations, a special head has been made to replace the headstock of a lathe; on the carriage of this lathe a special bed is provided to receive various fixtures for holding castings on which accurate boring is essential.

The headstock is provided with four precision spindles, as shown in Figs. 4 and 5, and is so made that the spindles are not only parallel, but are accurately spaced as to center distances and as to height with reference to the bed on which the fixtures are mounted. The fixture shown in the illustrations is for a drill press part. This casting has only one hole that requires sizing, which is performed by a carbide tool held in one of the four spindles. In machining other castings, however, from two to four of the spindles are fitted with tools which size a corresponding number of holes simultaneously and with high precision. At the same time, the center distances of the holes are held within close limits.

To provide for the precise location and accurate boring of seats for ball bearings and other types of bearings in certain castings, set-ups similar to that shown in Fig. 6 on a Heald Bore-Matic machine are employed. In these cases, the base of the casting and other points for establishing correct location are machined and the hole is rough-bored before the casting is ready for final boring. It is then located in a rigid fixture, such as that shown, and the bearing seats are sized with carbide tools, which remove about 0.010 inch of metal on a side and hold the size of the hole to within plus or minus 0.00015 inch. As the machine has spindles at each end, holes on each side of the casting are often finished in a single setting, with accurate alignment assured.

Many deep drilling jobs, some involving more than one hole and some only a single hole, are performed on hydraulic-feed drilling machines. A single-hole job of this type is shown in a box fixture at the right in Fig. 8. The work is fastened in place by quick-acting screw clamps, operated by ball-cranks. In the fixture shown, the drill is guided by two bushings which insure correct alignment. In this, as in many other cases involving a fairly long operation with one tool, the operator is able to perform supplementary drilling operations while the long one is in progress. Wherever possible, the extra drilling is done in a fixture that is set up permanently for one job only, as for the secondary operations shown at the left in the illustration.

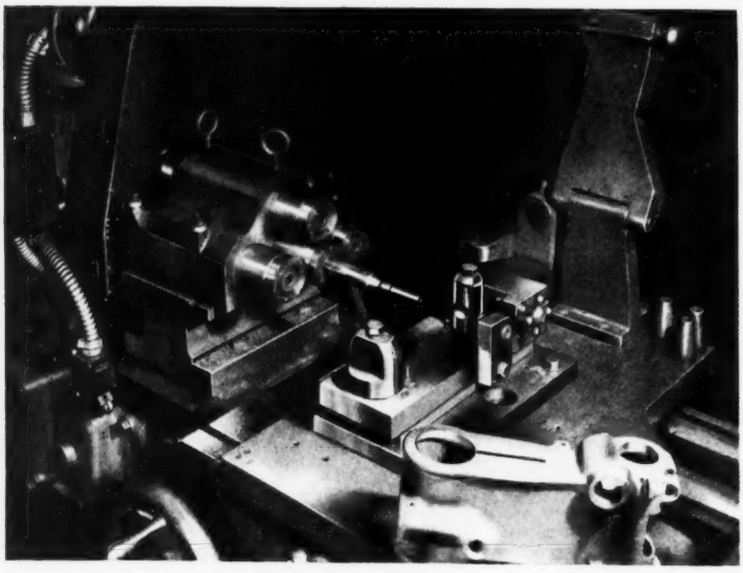


Fig. 4. Lathe Equipped with a Special Headstock Having Four Spindles for Precision-boring Casting Seen in Foreground

In this case, two Delta drill press heads are applied, one above and one below, to a standard column fitted into a standard base. The work is clamped in a fixture on a table mounted on the column between the two heads. One of the heads is arranged to feed the drill downward and the other to feed another drill upward simultaneously, the latter, of course, entering the work through the bed and a fixture bushing from below. This

makes for rapid and accurate work and saves turning the casting or the fixture over for a second operation. Upon completion of the run, the entire machine is placed in a tool store-room, where it is ready for subsequent use without making another special set-up. As the drill press heads are moderate in cost, the complete set-up involves only a small investment. The interest on this investment when the tools are idle is much more than offset by savings in time for new set-ups, otherwise needed, when the next run is made.

Fig. 7 illustrates another combined tool and fixture permanently set up to drill and tap holes in the edge of a saw table, which is a rather large casting. To set up the work successively under two separate drills in separate machines equipped with box or similar fixtures for correct location would consume much time and involve two rather large and expensive fixtures. The alternative here adopted is to mount two floor-base drill presses on a common base and fasten to the two columns a frame made from cold-rolled strip stock. Slides arranged to locate and hold the casting are mounted on the frame, and are provided with quick-acting clamps. After the casting is clamped in place, it can be brought quickly into location for drilling, and then slid to the tapping position without having to be lifted and relocated between operations. The whole assembly of fixture and tools is kept in tool storage between the runs, in which each time many castings are machined.

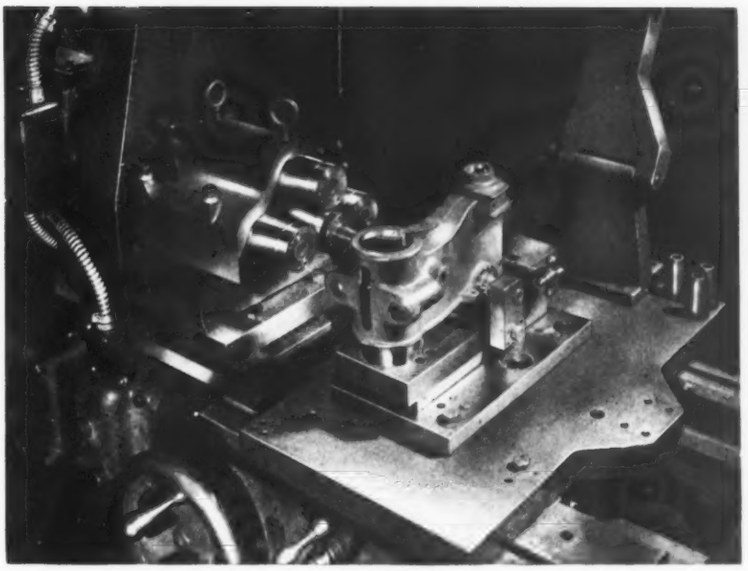


Fig. 5. Fixture Shown in Fig. 4 with Casting in Place

To drill a casting forming the upper arm of a jig saw, the combined fixture and tool shown in Fig. 11 is used. The fixture proper is a heavy plate to which extensions carrying drill bushings and clamps are attached. Back of the plate and below it are mounted standard drill press

Fig. 6. Casting Set up in a Fixture Used when Boring a Bearing Seat with a Carbide Tool

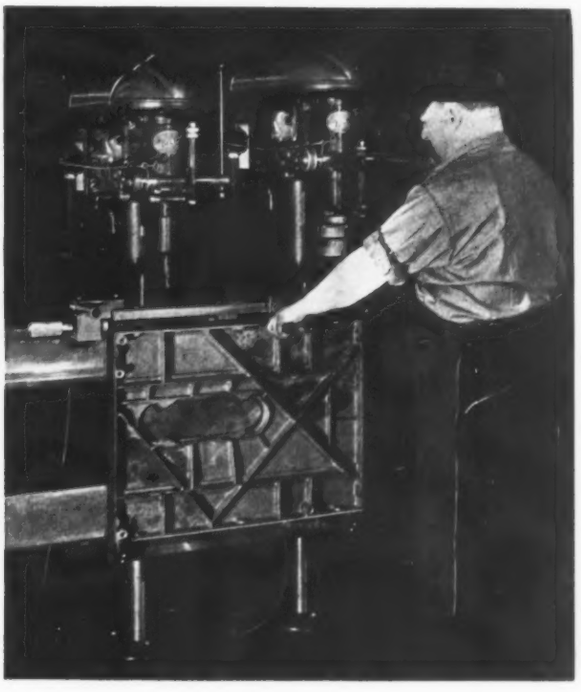


Fig. 7. Two Drill Presses with a Sliding Fixture for Drilling and Tapping a Large Casting

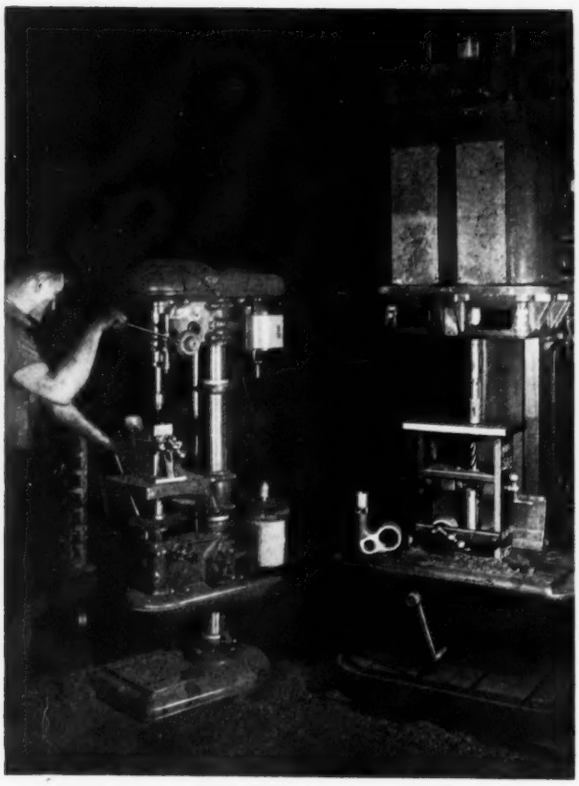


Fig. 8. (Right) Deep-drilling a Part Held in a Box Fixture. (Left) Special Arrangement for Simultaneously Drilling Same Casting from above and below

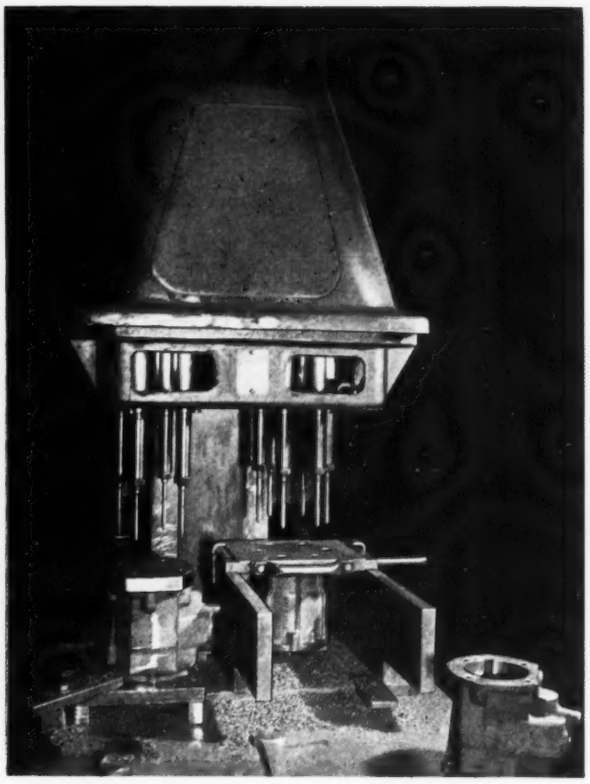


Fig. 9. Convenient Fixture for the Rapid Multiple Drilling of Flanges on Castings. The Opposite Ends of Two Identical Castings are Drilled Simultaneously

columns, one vertical and the other horizontal, each of which is provided with a standard drill head. This assembly is attached to a metal stand to bring the work to a convenient height. Each machine is fitted with two-spindle heads having drills spaced as required. It is a simple matter for the operator of the milling machine that faces the casting to drill the casting while the cut on the milling machine is in progress. Much time is saved by such a set-up, yet the work is accurately done, and by an operator who might be idle otherwise.

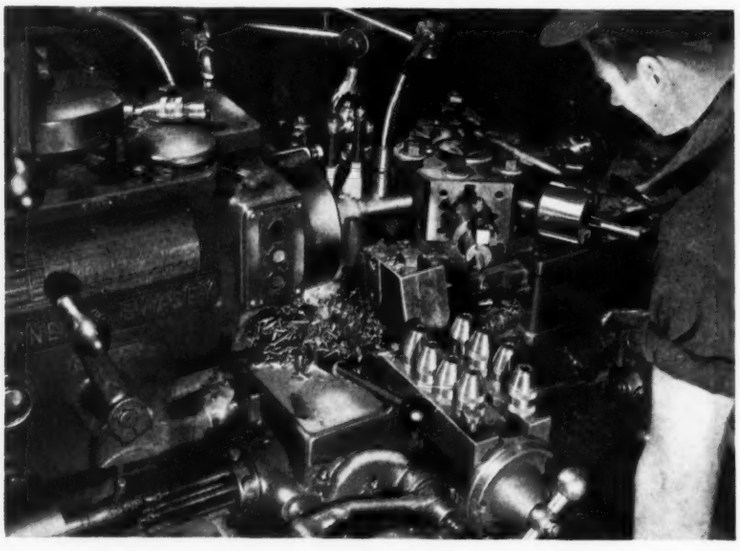


Fig. 10. Turret Lathe Tooling for the Production of Drill Chuck Bodies from 1 1/2-inch Bar Stock

Multiple drilling of both ends of the casting shown in Fig. 9 is quickly accomplished in a Natco multiple-spindle drill set-up. The fixture has a slide that carries drill bushings for the six holes in one end of the casting. The holder that contains the four drill bushings for the other end is fixed. The castings are positively located, but because of the nature of the operation, do not require clamping.

In Figs. 10 and 12, two views of the tooling provided on a Warner & Swasey turret lathe for making a drill chuck body are shown. The operations on this part are: (1) Spot center and knurl outside; (2) rough-drill center hole; (3) bore hole for thread and chamfer for tapping; (4) ream and taper-ream, using flat-faced tool; (5) tap; (All foregoing operations

Fig. 11. Fixture with Vertical and Horizontal Drill Heads Arranged for Drilling Holes in a Jig-saw Casting

Fig. 12. Another View of Turret Lathe Shown in Fig. 10 Tooled to Produce Chuck Parts in a Single Setting

are performed by turret tools.) (6) turn taper; (7) cut off. The latter two operations are done by cross-slide tools.

Among the unique combination tools and fixtures used in this plant is that shown in Fig. 13 for making scale graduation marks and numerals on a drill-press quill. The graduation marks are made 1/16 inch apart, and each graduation is made by a separate plate 1/16 inch thick, sharpened at its inner end and hardened before grinding. All the plates are stacked and fastened in a holder forming the upper portion of the fixture. Springs are arranged to hold the plates in their upper position so that the lower ends clear the quill when it is inserted in a hole running at right angles to the face of the plates. The plates are all the same length, and their upper ends project a uniform distance above the top surface of the holder. Above these ends is an arc-shaped length of spring steel, held by a screw at each end, the screws passing through short slots.

Above a second hole for the quill there are located punches, the lower ends of which have the numerals 1, 2, and 3 raised on them. Springs hold the punches clear of the hole in which the quill is placed. When in use, the fixture is placed on the table of a milling machine, the spindle of which carries a roller. After loading a quill in each hole, the fixture is traversed under the roller, which is set at such a height that the plates and punches are forced downward one at a time, each making an imprint or graduation mark to form the scale markings desired. This has proved to be a rapid, inexpensive way of performing the operation in a standard machine, not of the dividing type.

Not all the fixtures employed in the Delta plant are used for machining operations. Some

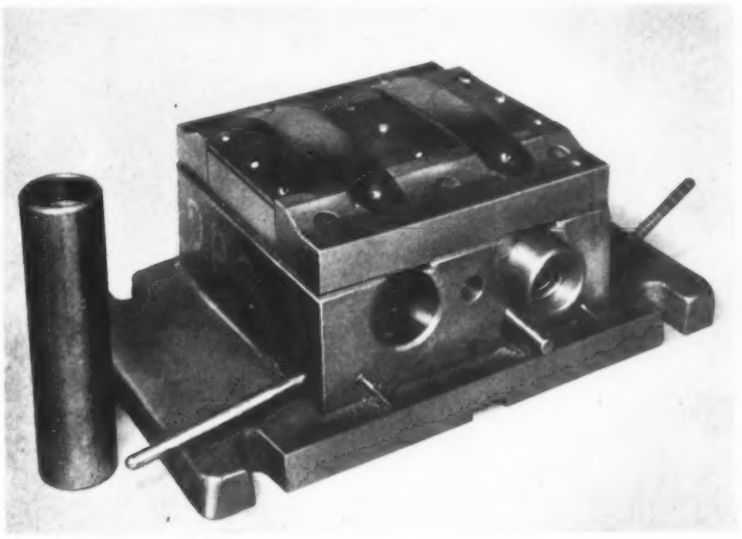


Fig. 13. Fixture Designed for Marking Scale Graduations and Numerals on a Drill-press Quill

are designed for assembly purposes, especially for assembly by welding. Fig. 14 shows a fixture of the latter type, made largely by spot-welding steel tubes together to form a box-like structure with open sides. It is employed to hold four angle-iron legs, a top, and a shelf in correct relative positions while these components are being spot-welded to form a base for a combination joiner and circular saw. After setting the parts in the correct relative positions in the jig, two men shift it on a steel horse into such positions that thirty-two spot-welds can be made, using a standard spot-welder. The open sides of the jig make it possible to bring each of the spots to be welded between the electrodes in such rapid succession that several assemblies an hour are made.

Another form of base, fabricated largely from sheet steel, is assembled by gun welding in the fixture shown in Fig. 15. This base, used for a tilting-arbor circular saw and for a vertical-spindle machine known in the wood-working trade as a shaper, is approximately square in horizontal section. The four sides or corner sections are of sheet stock formed around a fairly large radius into two planes at right angles to each other and having edges flanged inwardly. These four sections are placed inside the jig and are clamped in the correct relative positions. This brings the flange in one section against that in the next section. Most of the 125 welds required are used for joining each of the four pairs of flanges. To bring the flanges into a convenient position to be reached by the gun welder, the latter is applied through the top opening (seen at one side in the illustration).

The fixture is provided with circular end plates arranged to turn on rollers. The ends are spaced apart by tubes, and most of the remainder of the fixture is made from strip stock, welded together into a frame and bolted to the circular ends. The rollers that support the fixture are mounted in a cradle, which is pivoted vertically. In other words, the whole fixture is on a turntable, and can be moved quickly about a vertical as well as a horizontal axis. The cradle is carried on a stand mounted on casters, and is easily moved about.

* * *

Brazing in Three Places Simultaneously Every Thirty-Five Seconds

The problem of brazing a 3/4-inch threaded flange to a completely closed 20-gage sheet-steel container was solved by the use of induction heating equipment made by the Induction Heating Corporation, 389 Lafayette St., New York City. Inductors, energized by a Thermonic induction generator, were placed directly over the flange, thereby heating the flange and a small area of the sheet-steel container. By this method, it was possible to perform three brazing operations simultaneously in thirty-five seconds. A ring of silver alloy, placed in position previous to the heating, melted and flowed to form an air-tight joint.

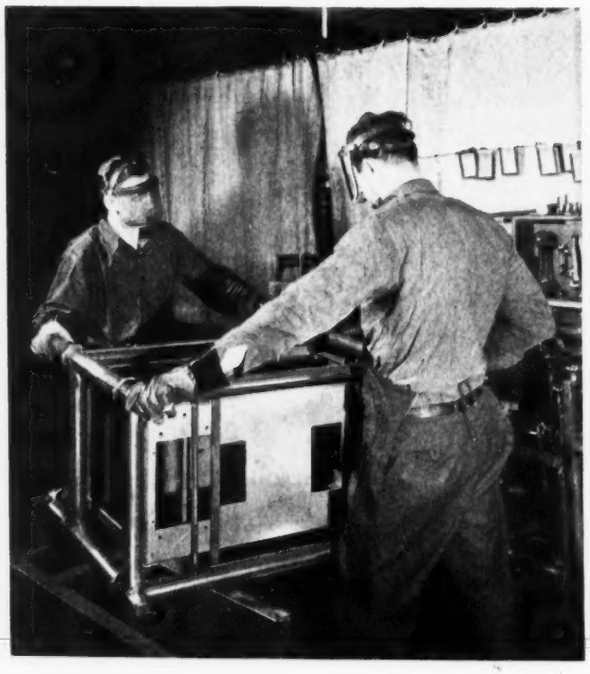


Fig. 14. Assembly Fixture Employed to Hold Parts of a Stand in Place while They are being Spot-welded

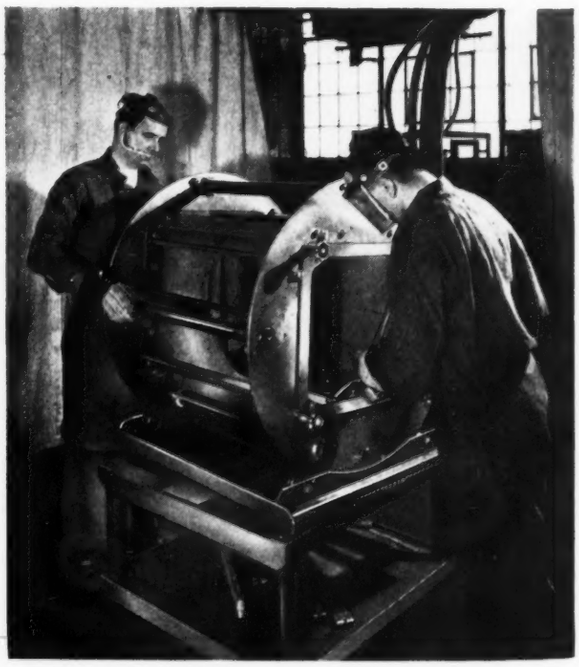


Fig. 15. Rotating Fixture Devised for Rapid Gun Welding of a Machine Base Formed from Heavy Sheet Steel

Combination Gages for Hole and Offset Checking

By F. HARTLEY

The slide bolt shown by dot-and-dash lines at *X* in the accompanying illustrations has an offset counterbore at *E*, Fig. 1, a slot *W* at one end, and a small crosswise hole *S*, all of which must be checked for size and for location with respect to each other. The diameter of the crosswise hole *S*, which passes through the flanges or sides of slot *W*, is checked first by "Go" and "No Go" gages. The diameter of counterbore *E* is also checked in the same manner.

The gage shown in Fig. 1 is then used to check distance *N*; the alignment of slot *W* having a width *P* at right angles to the axis of hole *S*; and the central position of this slot relative to the vertical center line through counterbore *E*.

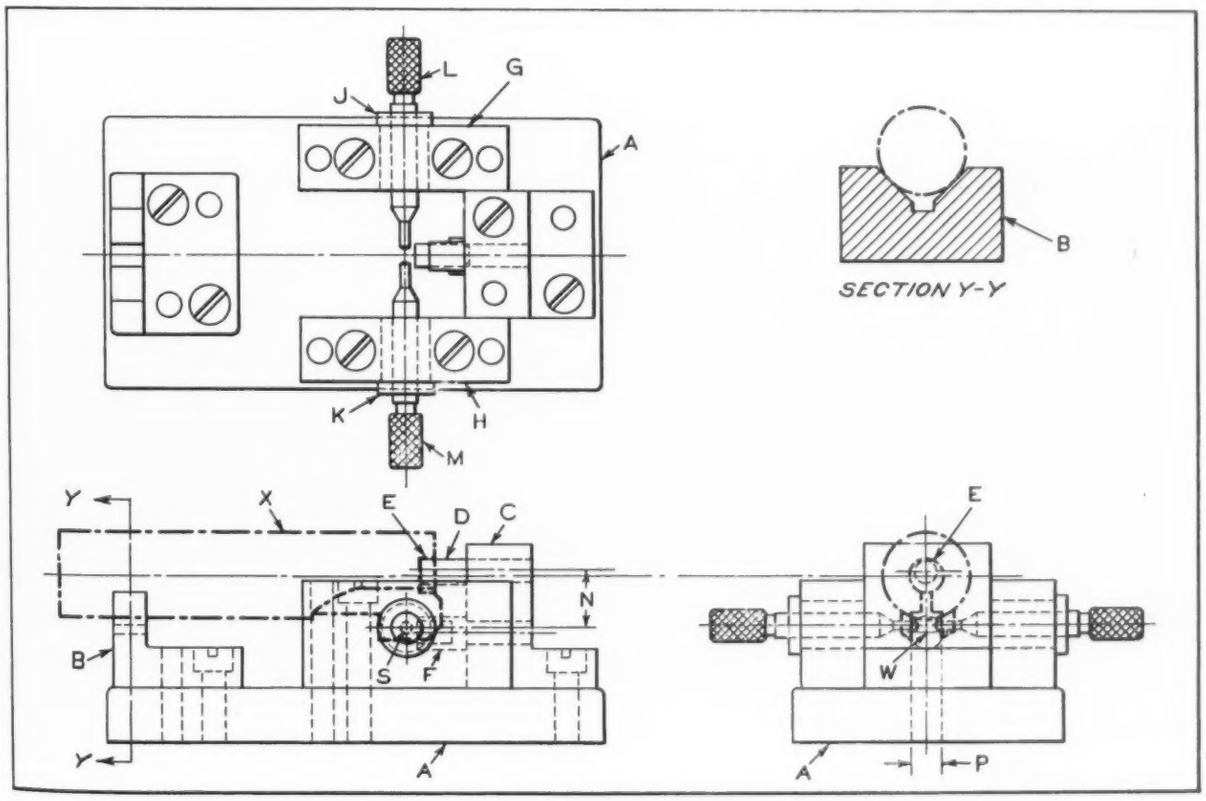


Fig. 1. Gage for Checking Positions of Counterbore E and Crosswise Hole S in the Slide Bolt X

The gage used for checking the dimension from hole *S* to the end of the bolt by means of a flush pin, and also the distance from the counterbore edge to the cross-hole with a step type "Go" and "No Go" plug is shown in Fig. 2.

Referring to Fig. 1, the gage consists of base *A* on which V-block *B* is mounted at the left-hand end. At the right-hand end another block *C* carries a locating pin *D* which enters counterbore *E* at the end of the work. A lower pin at *F*, which enters slot *W*, locates the work radially. Two side-blocks *G* and *H* carry bushings *J* and *K* through which gaging plugs *L* and *M* are passed for checking the locations of the two cross-holes *S* in the flanges or sides of slot *W*.

After bolt *X* has been checked in the gage shown in Fig. 1, the counterbored hole *E* is finish-ground. The bolt is then inspected in the gage shown in Fig. 2.

Advantage is taken of the inspection previously described to locate the work by means of knurled-head plugs *A* from the pair of crosswise holes. In addition, there is a lower block at *B* with a tongue which enters the milled groove in the work to locate it radially during the inspection. The combination of locating plugs and block, together with V-block *C* which supports the work from the outside diameter at the left-hand end, is all that is required to hold the part in position for the inspection. The diameter of the small crosswise hole is held within very close limits.

The work-locating plugs are slideably held in bushings driven in the two side-blocks *D* and *E* which, in turn, are held by screws and dowels to baseplate *F*. At the right-hand end, a block *G* is provided for holding flush pin *H* and step-pin *J*.

Dimension *K*, representing the distance from the small hole to the end of the work, is checked by flush pin *H*, the allowable limit or tolerance being represented by the step at *L*. Two dimension lines are shown at *M* and *N* which run from the small hole to the two steps on pin *J*. If the small diameter on the checking pin will enter the counterbore and the large diameter will not, the size and position of the counterbore are correct.

Solving a Troublesome Drilling Problem

By DONALD A. BAKER

A type of drilling job that frequently gives tool designers and production managers considerable trouble is shown in the accompanying

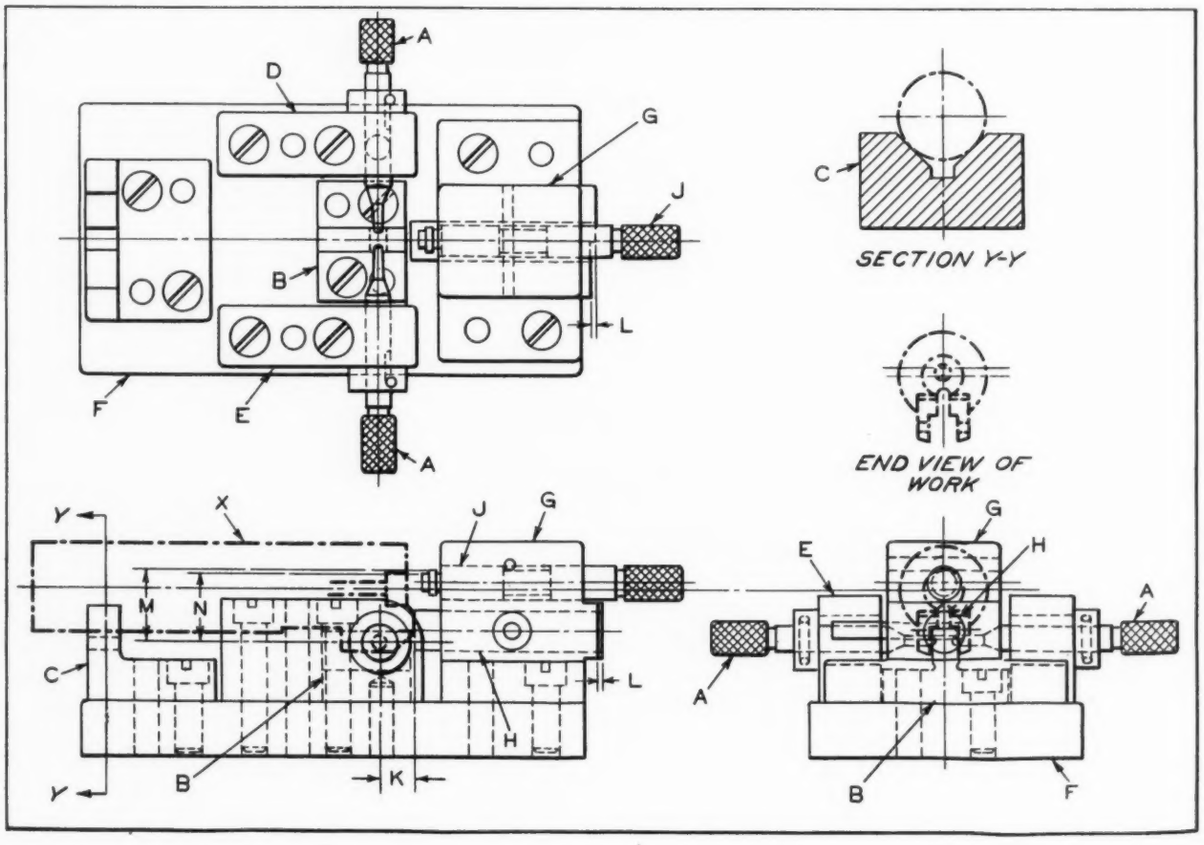
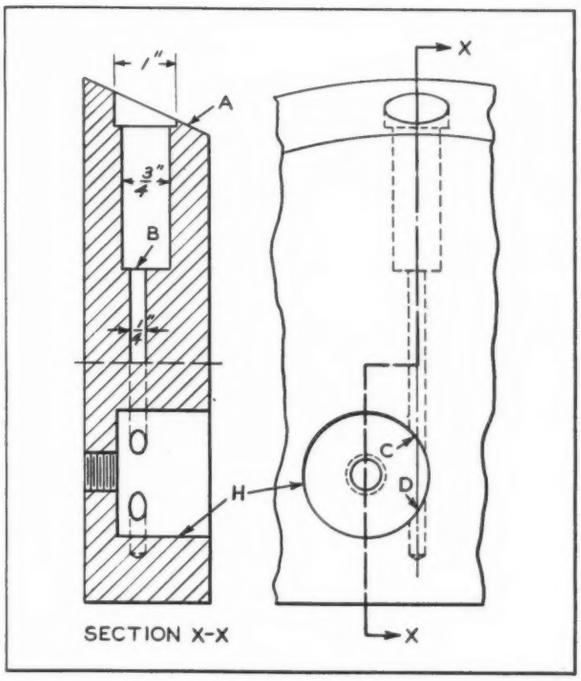


Fig. 2. Gage Equipped with Flush Pin for Checking Dimension from Hole to End of Piece and to Edge of Ground Counterbore



Work Presenting Troublesome Counterboring and Drilling Problem

illustration. It consists of starting the drilling operation on an angular surface and carrying it through other holes where the drill is forced to break out and re-enter angular or round surfaces, such as indicated at *C* and *D*.

These jobs, frequently encountered in crankshaft work, can best be handled by starting the hole on surface *A* with an end-mill type of cutter in which two lips extend to the center of the tool. The end-mill type cutters produce a smooth hole with a flat surface at the bottom. Next, a spot drill is used, which is guided by a slip bushing in the drilling fixture. This drill is smaller in diameter than the end-milling cutter, so that there is no chance for it to crowd against the sides of the hole or counterbore produced in surface *A* by the end-milling cutter.

The next step in handling this work is to drill the 3/4-inch hole, leaving enough stock at the bottom to permit squaring it with a square-end twist drill. After this has been done, an eccentric slip bushing, which is guided and held securely by the liner bushing in the drill jig, but does not touch the sides of the 3/4-inch hole, is inserted. The drilling of the 1/4-inch hole is then begun.

After this hole is well started, the guide bushing is removed so that there will be more space for the chips. To prevent the drill from running out while passing through the large hole *H*, a piece of cold-rolled steel of the right diameter to fit this hole is cut from bar stock. This piece is drilled through its center to permit it to be clamped in hole *H* by a cap-screw.

By turning this plug into different positions, it can be used for drilling four parts, after which it is thrown away and replaced by a new one. With one of these plugs in place, the action of the drill is practically the same as when drilling solid metal, there being no tendency for it to be deflected when breaking through into hole *H* at point *C*, or when entering the work again at *D*.

This method permits very accurate drilling with little difficulty. Any attempt to guide drills through bushings when there is a tendency for the drill to be crowded against one side of the bushing will eventually lead to trouble and should not be employed, because the wear and tear on both the drill and the bushing will be excessive.

* * *

General Electric Schenectady Works Receives Navy "E" Award

The Navy "E" symbol of excellence for furnishing material for the U. S. Navy was awarded June 20 to the management and employes of the General Electric Co.'s Schenectady Works. The chairman of the Navy Board of Production Awards, Rear Admiral W. T. Cluverius, made the presentation to J. M. Howell, works manager at Schenectady. The blue pennant, bearing an anchor and the letter "E," will fly from a flagstaff located near the center of the works for six months. At the end of that time, the production of the works is reviewed; and if the same standard that originally won the award is maintained, a service star will be added.

The presentation took place at the noon hour; in honor of the occasion, the avenue leading to the platform was decorated with 183 pennants, each bearing the name of a warship in service having propulsion equipment made by the General Electric Co. "The man in industry and the man in uniform today stand shoulder to shoulder," said Admiral Cluverius, "in the common endeavor of free men to annihilate the hordes of powerful ruffians who would enslave the world. He who makes the weapon and he who wields it are one. The Navy Department called upon industry to do almost the impossible and the response was stupendous."

* * *

The National Fire Protection Association, 60 Batterymarch St., Boston, Mass., is distributing a pamphlet entitled "Preventing Cutting and Welding Fires," outlining the ways in which a fire may be started when using welding and oxy-acetylene cutting equipment, and methods of preventing such fires.

A Management-Labor Cooperation Plan that has Proved Successful

A Management-Labor Cooperation Plan Has Been in Effect at the Lincoln Electric Co.'s Plant for Twenty-Eight Years. The Success of the Plan is Evidenced by its Effect on Production, Wages, and Selling Prices

WHEN an industrial organization is able to increase the production per worker to several times the average for the industry in which it is engaged, to pay annual wages that are the highest for steady employment in industry, and at the same time to constantly reduce the selling price of the product, it is evident that some unusual methods are being employed. Results such as these have been achieved by the Lincoln Electric Co., Cleveland, Ohio. This article will briefly review the methods and principles on which these achievements were based.

A brief resumé of the history of the company will serve as a background and make it easier to understand exactly what has been accomplished. The Lincoln Electric Co. was started in 1896 by the brother of the present head of the firm on $150 of borrowed capital. The business—the manufacture of motors—began in the basement of a dwelling house. In 1907, when J. F. Lincoln, now president of the company, had completed his education and joined his brother, the business amounted to approximately $50,000 a year. In 1913, illness prevented Mr. Lincoln's brother from continuing to manage the business, and J. F. Lincoln had to take his place at the helm.

With regard to his capacity for this job at that time, Mr. Lincoln says: "I had never had any manufacturing experience. I knew very little about the job, but I knew that it was beyond me, and I started out to do the one thing which seemed to me most necessary—that was, to get the cooperation of a number of men in the shop. There were not very many employes at that time, but a number of them I had to depend on if I was to succeed in this job. I had one fundamental idea: If I could make those men as anxious to make this business succeed as I was, it would succeed. I started out with that idea in 1914 and have adhered to it as a fundamental business principle since."

The manner in which this cooperative plan has been carried out is simple enough in principle. One man was elected from each department to meet with the head of the company as a member of an advisory board every two weeks. Starting in 1914, these advisory board meetings have been continued right along to the present time. The advisory board concerns itself with everything that has to do with the operation of the shop—with wages, salaries, shop policies, conditions of operation. Matters of this kind are definitely decided at these meetings.

Some of the early results from these conferences might be mentioned. In 1914, fifty-five hours a week was considered a normal workweek in this plant. At the suggestion of the advisory board, a fifty-hour week was established. Wages were increased by 10 per cent, so that the weekly earnings would remain the same. Shortly afterward followed a life insurance plan through which everyone in the company's employ is insured for a year's salary, the company paying the entire premium. Next followed something that was not done in industry at that time in the case of hourly wage earners—that was, vacations with pay were given. The plant was shut down during the second and third weeks of August of each year.

Conscientious Effort Merits Special Reward

Gradually, in spite of steady reductions in the prices of the products, the profits grew, and the idea of paying a bonus to every man and woman employed by the company was born. If everyone was doing their best, they all had contributed to the company's success and were entitled to share in the earnings. This bonus system was inaugurated in 1933. Mr. Lincoln says that the idea really came from the speech made by President Roosevelt in which he referred to "the more abundant life." The advisory board brought that idea to him. He was not certain at the time what the results might be; but he is now convinced that an equitable bonus plan will increase output and decrease cost, and that it is, therefore, more than justified.

The amount of the bonus is determined by the profits of the company in any one year. A certain percentage of the profits is set aside and divided among all the people working for the

company. Ninety per cent of the amount set aside goes to the factory workers; the remaining 10 per cent is divided among those who hold executive positions, according to an estimate of their actual value to the company during the past year.

What Are the Results that have been Achieved?

Results such as achieved by this company cannot be referred to by generalities. Business men and engineers will ask for facts. These are the facts: In 1933, when the bonus plan was inaugurated, the company had 325 employes and the average output per employe was $8371. Two years later, in 1935, when the company had 480 employes, the productivity, as measured in sales volume per employe, had risen close to $11,000. In 1937, this figure had become $18,150, and, in 1941, it was over $25,000. It should be noted that in 1935, when this company had a productivity per employe of nearly $11,000, the average for the electrical machinery apparatus and supply industry as a whole was not quite $5400. In 1937, the last year for which complete figures for the entire industry are available, the industry productivity per employe was $6295, compared with $18,150 for the Lincoln company.

So much for production. In 1933, the average annual income per employe was $1525. As this was a depression year, the average annual income per worker in the entire industry was only $884. In 1937, when the average for the electrical industry was $1381, the 590 Lincoln employes averaged $3407. In 1941, this figure rose to $4879—an annual average for 960 workers.

Meanwhile, what happened to prices and the products sold by the company? A welding machine selling for about $600 in 1933 sold for $550 in 1935, and $380 in 1940. In 1941, a new design was brought out selling for $200; but the capacity of this new machine was the same as that of the earlier type.

Similar price reductions have been made in electrodes. Minimum prices in carload lots per pound were 11 cents in 1934 and less than 5 cents in 1941. At that time, the average hourly rate, exclusive of the bonus, was the highest ever paid, and the bonus itself was the highest in the history of the company, making the employes the highest paid workers permanently employed in industry.

Mr. Lincoln's contention is that what has been achieved by the company of which he is the head can be achieved elsewhere through the same methods and by the application of the same principles. The first thing is to create such an atmosphere that everybody feels that he is not working for any individual, but is working for the company and for himself. "The plan," says Mr. Lincoln, "has got nothing unusual or mysterious in connection with it, but it must be adopted with sincerity and not merely as an expedient; it must represent a permanent policy and not a temporary effort to satisfy some immediate demands."

* * *

The Record-Breaking Pace of Industry

Orders received by the General Electric Co. during the second quarter of this year amounted to $566,250,000, more than double the volume for the corresponding three months last year. During the first half of this year, the company's orders amounted to $865,370,000, compared with $521,140,000 for the same period of 1941, representing an increase of 66 per cent.

Members of the Executive Committee in Charge of the War Production Conference of the American Society of Tool Engineers, to be Held at Springfield, Mass., October 16 and 17. Seated, Left to Right, are Andrew P. Schoeffler, Chairman, Southern Connecticut Chapter; Edward C. Sheldon, Chairman, Springfield Chapter; Frank W. Curtis, Past-president of the Society. Standing, Harry J. Hauck, Chairman, Hartford Chapter; Ray H. Morris, Vice-president of the Society; and Edward J. Berry, Chairman, Rhode Island Chapter

What the Product Designer Should Know About Plastics

Characteristics and Application of Plastics, and Directions for the Design of Plastic Molded Parts for Economical Quantity Production — Last of Five Articles

By ERIK FURHOLMEN, Chief Estimating Engineer
Chicago Molded Products Corporation

WHILE most plastics lend themselves moderately well to machining, it is good economy and often preferable to so design the part that subsequent machining is either eliminated or minimized. For appearance, so-called "mold finish" is generally sufficient and more lasting than that on surfaces which have been machined and then buffed. Machining can be avoided, in general, if under-cuts are not required and if the various parts or holes can be formed by sections of the mold, or are not at such an angle or of such shape that normal molding is not feasible.

In more complicated mold designs, as explained in a previous article, it is possible to use cams, inserts, loose sections, split cavities, or the like, to effect successful molding of very complex and irregular designs. But in designing the piece, the various parts of the mold should be visualized to see that they have ample sections for adequate strength, as well as to resist constant changes in temperature.

Hinges, catches, and other fastenings can often be an integral part of the molding, as seen in Fig. 37, or they may have to be metal parts that are imbedded as inserts, as shown in Fig. 38. At least one make of spring hinge which is applied without machining the molding or using metal inserts is available (see Fig. 39).

Quite often, however, holes are either molded or drilled and tapped in the moldings, and metal hinges, catches, or locks are subsequently fastened to the assembled parts by means of screws (see Fig. 40). The use of drive screws and of self-tapping screws is feasible if holes sized to suit are provided; but cracking is likely to result unless the section is such as to provide plenty of plastic around the screw.

Fig. 41 shows a form of hinge involving small under-cuts, but the conical projections and the holes they fit are so small that the molding can be sprung slightly and without injury in ejecting it from the mold and in later assembly.

Threads, both male and female, can sometimes be molded, if not too fine or too small in diameter, but molding costs may be greatly increased when threads are molded. The coarser a thread is, the easier it is to mold. Threads of rounded contour for bottle caps are always molded in the cap and it is feasible to strip the caps off the studs which form the core, thus saving the time otherwise required to unscrew the caps from the cores.

Stripping of this type is not successful unless done before the material becomes hard and brittle. It cannot be done if the design is such that the elasticity of the material cannot be utilized because of mechanical interference, or because the structure of the part does not admit of the stretching which stripping entails. It is usually necessary to unscrew a part molded over a threaded stud or to unscrew the stud from the molding, especially if reasonably close dimensional limits are required.

Male threads can be molded only at mold partings or by using split sections in the mold, or by unscrewing the molding from the mold or a part of the mold from the molding. Such operations, though often feasible, require time and result in added mold cost and in greater molding cost. It is sometimes better to use threaded metal inserts than to mold threads on or in the piece. Female threads can be tapped in some moldings, but tapping is often rather difficult, as taps wear out rapidly and require frequent sharpening. Male threads can be cut or chased, but involve difficulties similar to those that are encountered in tapping.

Design from an Appearance Standpoint

Manufacturers on the alert for products that have sales appeal know the importance of good appearance in the product. Besides providing simple and attractive lines and shapes, it is necessary to select proper material and the best

color. Unless the manufacturer has his own stylists, who are thoroughly capable, it is best to employ a qualified industrial designer for styling the product before the engineering design is so far advanced that changes in size and shape cannot be made.

Primarily, the part should be designed so that it adequately serves its purpose mechanically, electrically, chemically, and in other respects. The designer must consider also how the part can best be molded, and, if necessary, make sufficient alterations to facilitate molding without sacrificing the essential functions of the part. Qualified custom molders may well be asked to offer expert advice on this point. At the same time, appearance requires attention so that the product will have sales appeal. Designing products for appearance and saleability is fundamentally an engineering problem, and the ideal designer is a type of artist-engineer, who can visualize and correlate engineering, production, and appearance to best advantage. All designs to be produced as plastic moldings should be checked to make sure that they come within the bounds of practical molding procedure.

In plastic moldings, the material itself usually contributes much to fine appearance, as well as to structural soundness. But symmetry of form, simplicity of lines, a fairly uniform wall section, minimum size commensurate with other requirements, generous curves to facilitate free flow of the plastic material in the molding pro-

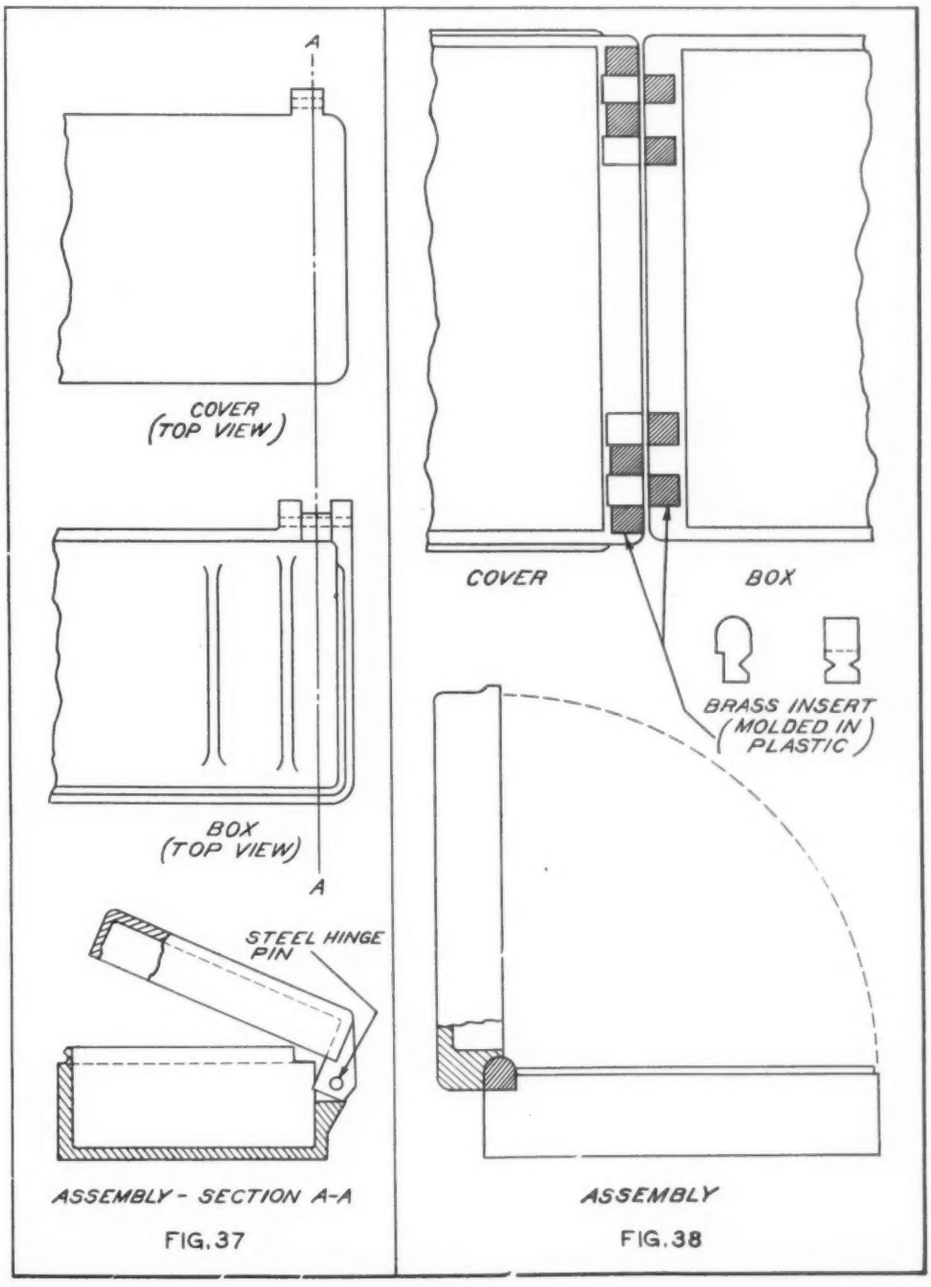


Fig. 37. Conventional Hinge Having Projections through which the Pin-hole is Drilled. The Cover Molding Has Two Projections which Fit between Two Pairs of Projections in the Base

Fig. 38. Hinge which is Made by Inserts Embedded in Thick Sections of the Moldings when they are Made. Holes for the Pins are Drilled Subsequently

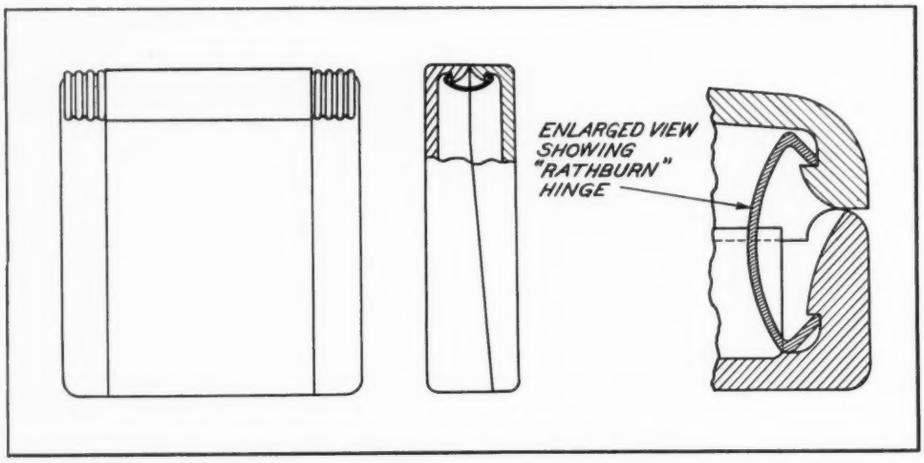


Fig. 39. Type of Hinge that Holds the Moldings together by Means of a C-shaped Spring which Snaps into Place. The Edges of the Moldings at the Hinge are so Shaped that the Cover Rocks and is Held Open Automatically when Moved 90 Degrees

cess, and judicious choice of color, all are essential factors in a design deserving to be called "good."

There are no hard and fast rules for choosing a color or color combination. It is, however, usually considered wise to avoid large areas of vivid color and to employ such color chiefly for accent. Neutral and pastel hues are more generally favored for major areas, but they can often be broken up profitably by using contrasting or complementary colors. Yet the value of a certain color cannot be overlooked if the merchandise has long been identified by this color. Complementary tones are often employed on accessories to accentuate and enliven the central color in particular cases.

Generally speaking, the lighter colors carry the greater sales appeal, especially for feminine buyers. Blue, green, purple, and some shades of gray are among colors that are generally classed as "cold" or "cool" colors. They do not excite the emotions, as do red, yellow, and orange, which are known as "warm" colors. When plastic products are worked out in the cool colors, they usually appear larger than they actually are. Conversely, warm colors have the opposite effect.

Designers generally do not favor the use of mottled colors, especially if the mottles are pronounced. Solid colors are preferred. On the other hand, so-called "mahogany" and "walnut" effects (presumed to simulate wood grains) have a certain utility. Sometimes their use serves to hide defects otherwise more apparent, and this lowers costs by reducing rejects. So-called "wood grain" effects have a certain appeal in such products as radio cabinets and bezels for wooden cabinets, even though they do not, in reality, closely simulate wood.

Appearance is often enhanced materially by the use of clear transparent plastic moldings or tinted transparent materials. They afford a depth not secured otherwise and a high degree of light transmittal. Translucent molded plastics have a similar appeal, but usually give less depth and greater light diffusion. The latter quality is especially useful in lighting accessories, and makes feasible such products as the bowls of lighting fixtures, for which ivory tints are usually preferred.

These are among the factors bearing upon appearance which deserve and often require the judgment of a qualified artist, preferably one with experience in styling for a particular trade. No matter how skillful a designer may be, from a strictly engineering standpoint, if he lacks ability to make his product "look the part" and appeal to those who are influenced by beauty of line, form, and color, he should be guided by those who have this ability. On the other hand, it should not and need not involve sacrifice in function or performance from a utility standpoint to take advantage of really good styling.

Ability to perform a particular function is usually an absolute essential, but not the only one. It is futile to turn out a design that is functionally perfect but that, for lack of good appearance, cannot be marketed successfully. This applies, of course, chiefly to products commonly exposed to view. In hidden parts, which are seldom or never seen by the purchaser, appearance may be of little or no consequence, whereas proper functioning is the primary, if not the only, consideration, except that cost must be held within required limits.

Since really good design usually requires utmost simplicity in line and form, such a design is often the most economical from the standpoint of minimum cost in manufacture. There doubtless are cases in which improved appearance increases the cost, but even then the greater sales appeal may offset the increased cost.

Letters, Numbers, and Trademarks

Letters, numbers, and characters, whether raised or depressed, should be placed in such a position that they do not interfere with the ready

withdrawal of the molding from the mold. They should be either on the top or bottom of the piece or in a plane perpendicular, or nearly so, to the line of travel of the force. They can be placed either on a curved or angular surface, provided they do not involve under-cuts. About the maximum angle that a plane forming the base of the letters or characters may make with the line of travel of the force is 45 degrees. Wherever placed, the characters have to be carefully constructed, so that no under-cuts are inadvertently made. Letters of the block type are the easiest and cheapest to produce, as engravers generally are supplied with various standard sets of these, so that expensive hand work is not necessary.

Letters or characters that are engraved in a cavity or stamped in a force appear raised on the finished product. As it is much easier to "deboss" by engraving into the mold than to produce embossed or raised letters or characters in the mold, raised letters or characters on the molding should be specified if lower mold cost is a factor. In the event that the cavity is hobbed, however, the reverse is true, as the engraving is then made in the hob, and the latter produces raised letters in the die, so that the molding has recessed letters. Depressed letters and characters on the molding are, in general, readily filled with paint, giving a pleasing and striking contrast at low cost. Letters thus "wiped in" are quite permanent, because the paint, being below the surface, is not likely to be abraded or worn off.

Hot Stamping is the term generally employed to describe the process of marking molded objects with letters, numbers, insignia, etc. This operation takes place after the part has been molded, trimmed, and otherwise finished. The part to be stamped is securely held in place while a stamp (underneath which is an acetate or cellophane film or ribbon, gilded or otherwise colored) is pressed into contact with the film, which, in turn, is forced against the molding. The stamp is heated, generally by electricity, and pressure against the molded piece imparts an impression and causes the film to adhere to the piece where the letters press against it. The press employed usually resembles a "kick" press; but where high production is required, a power press with automatic feed, is employed.

Hot stamping may be specified upon either thermoplastic or thermosetting materials. The operation is generally cheaper than to have the characters engraved in the mold and then filled with color, as an added hand operation, but the latter generally produces a better appearing job. Recessed letters and numbers molded into the piece sometimes are filled in by using a hot stamp, as outlined, to force a film into the recesses, this being more rapid than the hand filling and wiping operations.

This and the preceding articles on "What the Product Designer Should Know About Plastics" were abstracted from a chapter to be included in a forthcoming book by Herbert Chase entitled "Designing for Quantity Production."

* * *

Simplified Practice Recommendation for Files and Rasps

A revision of Simplified Practice Recommendation R6-40, Files and Rasps, has been approved by the industry group concerned, according to an announcement of the Division of Simplified Practice of the National Bureau of Standards. The revision lists 324 American pattern files and rasps, or 14 per cent fewer sizes and styles than the 1940 edition. It omits 55 items that the Office of Production Management, in its letter to the industry of August 6, 1941, requested be discontinued for the duration of the emergency. The inclusion, for the first time, of important data on dimensions, cuts, and tolerances, it is believed, will greatly facilitate the simplification program. Mimeographed copies of the recommendation can be obtained, without charge, from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

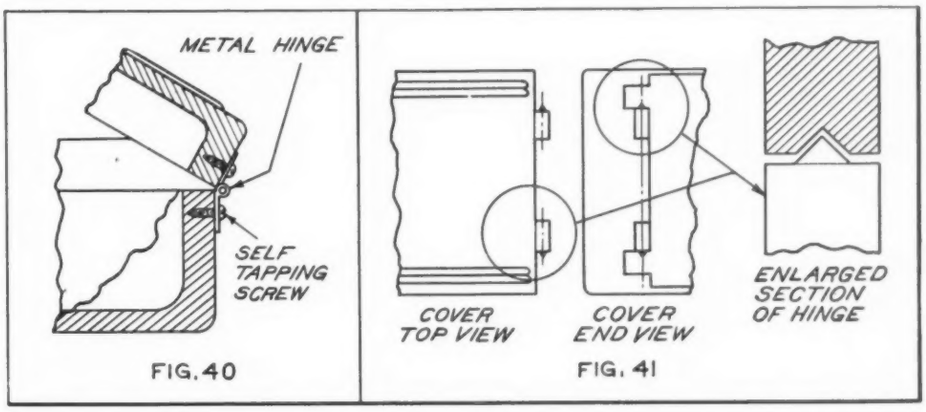


Fig. 40. Metal Hinge Fastened to the Moldings with Self-tapping Screws

Fig. 41. Form of Hinge Using Molded Conical Projections which Mate with Corresponding Conical Holes in the Other Molding

Industrial Lubricating Recommendations

By HOWARD R. PETERSON and J. WILLARD PETERSON
Standard Oil Co. of Indiana, Chicago, Ill.

WITH the demand for increased industrial production, correct lubrication assumes greater significance. The responsibility for efficient lubrication is shared by the user of the equipment, the lubricant supplier, and the equipment manufacturer. Under normal conditions, the responsibility of the latter is perhaps less than that of the other two. Plants may enlarge or replace obsolete equipment with new, but those who are in charge of maintenance and lubrication are generally able to take care of the new machines without serious difficulty.

A new and different situation has arisen, however, in connection with the complete conversion of plants to war production and the construction of entirely new plants. With much of the new equipment the personnel is unfamiliar; methods and practices have not been established; promotions, transfers, and induction into the armed services result in the responsibility being thrust upon employes lacking in experience and training. Upon whom will they rely for advice concerning maintenance and lubrication? In most cases, certainly, upon the manufacturer of the equipment, since he is most familiar with its construction and operation, and since it is to his interest that the machine perform satisfactorily. In what manner, then, can the manufacturer best serve his customers in their quest for information? An examination of the attitudes of various concerns toward lubrication recommendations may assist in formulating a policy that will best serve the interests of all concerned.

Who Should Make Recommendations?

Some equipment manufacturers prefer to assume no responsibility for the selection of proper lubricants, frequently suggesting that a reliable oil company be consulted. This is quite satisfactory in many cases, particularly those not involving high speeds or complicated mechanisms. In the event that a machine is sold in a remote district, however, it is possible that a competent lubrication engineer may not be available, and the selection of lubricants would perforce be delegated to men who are entirely unfamiliar with industrial lubricants, thus resulting in the possibility of improper lubrication.

The various representatives of manufacturers who follow this procedure are invariably called upon by their customers for advice, and find it virtually impossible to avoid making a recommendation. This results in confusion and inconsistencies, which eventually induce the manufacturer to alter his policy.

Recommending Specific Brands of Lubricants

Some concerns adopt the policy of recommending one particular brand of lubricant known by them to be satisfactory. This recommendation may be made known to the purchaser by means of a plate affixed to the machine, by lubrication manuals or operating instructions, or through service men and erecting engineers. Such plates or manuals usually state that "X" oil, manufactured by "ABC" Oil Co., should be used, sometimes adding "or an equivalent."

A recommendation of this type frequently leads the user to believe that only "X" oil is satisfactory, since the selection of an "equivalent" product may be difficult. Must an equivalent product be identical with "X" oil in all physical and chemical properties in order to be equally satisfactory? This, obviously, is not usually the case. Were large metal-working plants to attempt to follow the specific recommendations of each machine builder, they would probably find it necessary to purchase a number of lubricants which, for all practical purposes, are identical, and to divide their business so that quantity discounts would be sacrificed.

In the case of an "or equivalent" recommendation, a purchaser may rely upon his regular supplier of lubricants to determine the "equivalent." This may involve obtaining specifications or physical characteristics through an analysis of a sample of "X" oil, resulting in unavoidable delay and, in some cases, uncertainty on the part of the user that the recommendation finally made is a correct one. Although the oil specified may be well known, lubrication engineers and salesmen who are called upon to recommend an equivalent may not be sufficiently familiar with it to make a proper selection.

Specifications Aid in Reducing Number of Grades of Lubricants

Many large users, such as motor car manufacturers, railroads, and government agencies, purchase lubricants on the basis of specifications, and have succeeded in reducing the number of grades to a minimum. It is extremely unlikely that they will conform to any specific brand recommendation, but will attempt to determine which of the products in stock is best

adapted to the new machine. To do otherwise would complicate purchasing, stock control, and lubrication practices.

There are, of course, exceptional cases in which a specific recommendation is necessary. When hypoid gears were first introduced, it was found that only one gear lubricant was satisfactory. The policy of recommending that product was changed, however, when suitable lubricants were made generally available.

Virgil M. Palmer and Charles L. Pope, of the Eastman Kodak Co., stated in a paper read before the American Society of Mechanical Engineers: "We find that the practice of equipment manufacturers in specifying lubricants by brand names, on the nameplate of equipment, in operating instructions, or through verbal recommendations of erecting engineers, tends to interfere with a program such as ours where we are endeavoring to standardize lubricants. Prejudices often develop among the operating personnel through knowing what brand was specified."

Supplying Lists of Satisfactory Lubricants

Other manufacturers, in an effort to be impartial to lubricant suppliers, as well as to be of maximum service to their customers, compile a list of approved lubricants. This list may be restricted to products that have been subjected to shop and laboratory tests, for which a charge is sometimes made, or it may merely be based upon the recommendations of lubricant suppliers. In the first case, an enormous amount of time and expense may be involved in testing samples, while in the second, products of widely varying characteristics are usually included.

In either case, the task of revising the list at frequent intervals, in order to make required changes in brand names and include newly approved products, is an unending one. Some lists have gradually been expanded until they contain more than a hundred brand names, yet fail to include many that are equally satisfactory, although perhaps less widely distributed. Despite these objections, a number of manufacturers have found an approved list satisfactory, particularly when limited to a relatively few products of wide distribution and known merit.

Lubricants Recommended on the Basis of Specifications

An increasing number of equipment manufacturers have found it expedient, and of the most value to their customers, to recommend lubricants on the basis of a description or specification. For all but an insignificant number of applications, this method is successful in assuring correct lubrication. It greatly simplifies the problem of both the machine user and the lubricant supplier. It enables the user to determine at once whether or not a product already in use in his plant will be satisfactory. If not, it permits him to consult with his regular supplier, rather than requiring him to communicate with some specific oil company with which he may be entirely unfamiliar or that may have no representative in the locality. Palmer and Pope, in the paper referred to, state: "We find machinery nameplate data giving physical characteristics and type of lubricant recommended extremely helpful in our lubrication program."

What to Include in Specifications

In recommending lubricants on the basis of a description, care must be taken not to make the specifications more restrictive than is required by the service, and yet to have them sufficiently definite to assure a satisfactory product. Specifications so narrow that the user is limited to one brand are not unknown, and some have even excluded products of superior quality resulting from subsequent advances in the technique of refining. Whenever possible, the specifications should be based on standardized methods, such as those issued by the A. S. T. M.

S A E viscosity designations, while suitable for the automotive equipment for which they are intended, are not sufficiently specific for most industrial recommendations. A line of industrial circulating oils, for example, may comprise fifteen or more grades, differing principally in viscosity. Several of these may fall within one S A E classification, yet their industrial applications may differ widely. It is preferable, therefore, that viscosity be designated in terms of the Saybolt Universal scale at 100 degrees F or 210 degrees F. The use of S A E designations may also lead to the use of motor oils of a detergent type, which, in many cases, are unsuitable for industrial applications.

Specific gravity is seldom of importance and, unless oils of certain origin are required, should be omitted from a specification. Flash, pour, demulsibility, color, carbon residue, and viscosity index may be specified when it appears that they are of significance in obtaining satisfactory performance. In general, it is by no means necessary that a detailed or intricate specification be provided, since its purpose is to serve merely as a guide for lubrication engineers. In writing a description of this nature, many equipment manufacturers find it helpful to consult representatives of various refiners and oil marketers.

Because of the rapidly changing conditions confronting industry today, many concerns are finding it advisable to review their lubrication recommendations. It is hoped that the points briefly presented here will assist them in formulating a policy that will be of the maximum benefit to the users of their equipment.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Flux for Joining Cutting Tips to Tool Shanks

A flux that is said to greatly facilitate the joining of cutting tips to shanks has been brought out by Krembs & Co., 669 W. Ohio St., Chicago, Ill. It is suitable for joining carbide and all other types of cutting tips to their shanks, and can be used in conjunction with furnace, torch, or spot-welding methods.

The material, known as "Fluxined-Spelter" is brushed on the contacting surfaces of both the cutting tip and the tool shank. Then the work is assembled to form a tight fit and brazed. When completed, the finished joint looks as if it were gold-plated, showing no waste of joining material and requiring practically no cleaning. The bonds obtained are said to be exceptionally good. 201

Substitute Material for Nameplates, Metal Tags, etc.

Many manufacturers have found it necessary to use a substitute material for nameplates, metal tags, patent number plates, etc. A product made by Avery Adhesives, 451 E. Third St., Los Angeles, Calif., under the trade name "Kum-Kleen" is being offered as a substitute. This material adheres permanently to any smooth surface, whether metal, glass, plastic, enamel, varnish, or wood. It is applied without moistening, and adheres even when exposed to high temperatures or changing climatic conditions...202

Compound for Fighting Incendiary Bomb Fires

A new dry fire extinguishing powder, duMag, developed specifically for extinguishing magnesium and incendiary bomb fires has recently been announced by DuGas Engineering Corporation, Marinette, Wis. The manufacturer claims that it takes less of the compound than it would of sand or salt to extinguish a fire of this type. The material is moisture-resistant; remains free-flowing even when stored for long periods; is non-abrasive; and will not react with burning magnesium. The advantage over a water spray is that duMag will extinguish the fire quickly, while a water spray can only be used to accelerate the fire and thus shorten the burning time. duMag has been tested and approved by the Factory Mutual Laboratories for magnesium alloy fires. The powder can be applied directly from the container to the fire or to the burning bomb with scoop, shovel, or other mechanical means. 203

A Synthetic Rubber Product with Improved Qualities

A recent accomplishment in the field of synthetic rubber research has been the development by the B. F. Goodrich Co., Akron, Ohio, of a superior type of hard rubber made from Ameripol, a synthetic rubber product. The new synthetic hard rubber is claimed to withstand, without softening, temperatures up to 100 degrees F. higher than the best natural hard rubber. This new development is expected to extend the field of hard rubber, since it removes many of the limitations that have restricted its use under extremely severe conditions.....204

Unusual Acid- and Alkali-Proof Coating

A protective coating that is claimed to withstand the attack of any acid or alkali, regardless of its concentration, at temperatures below 300 degrees F., has been placed on the market by Protective Coatings, Inc., 10391 Northlawn, Detroit, Mich., under the name of "Chempruf."

The coating is available in two types—A and B. Type A is a brush-on heavy liquid that can be applied by any workman; Type B is a plastic that hardens to withstand heavy-duty service, and should be applied only by workmen who have been specially instructed in its application. "Chempruf" starts to soften at 300 degrees F. and melts at 510 degrees F. It is not recommended where exposure to mineral solvents, oils, and greases is anticipated.

To obtain additional information about materials described on this page, see lower part of page 158.

An average of four coats of "Chempruf A" is sufficient to protect a part where mechanical abuse is not present. Additional coats may be applied as determined by service conditions. "Chempruf B" is applied in thicknesses ranging from 1/8 inch up, depending upon the service expected and the likelihood of mechanical abuse.

This coating is expected to find wide application in the protection of plating and acid tanks, fume ducts, storage and processing tanks, and other surfaces, including ceramics which are exposed to destructive agents. 205

Weather-Resistant Blackout Paint for Outdoor Application

A blackout paint for outdoor application which dries in thirty to forty minutes to a self-leveling, dull, flat surface has been made available by the Midland Paint & Varnish Co., 9115 Reno, Cleveland, Ohio. The paint, known as P-40, is resistant to heat, and is unaffected by exposure to sunlight, rain, sleet, snow, or exhaust steam. It can be readily removed by wiping off with an inexpensive solvent.....206

Conductive Belting Ends Static Hazard

A conductive rubber belting, designated as "Uskon," which does not accumulate the static electricity ordinarily generated on the surface of belting due to friction has recently been developed by the United States Rubber Co. This conductivity feature is especially desirable in hazardous areas where a discharge of the accumulated static electricity might produce fire or explosion. This new belting is also useful for handling material, such as paper or cellophane, which carries an electrostatic charge and causes difficulty by adhering to a non-conductive type of belt.

The new transmission belts are of the friction-surface envelope type, and have been successfully subjected to severe electrostatic tests at speeds ranging from 100 to 4000 feet per minute, with humidity as low as 16 per cent. Conductive V-belts of similar design are also available. 207

Iron-Base Cement for Patching Concrete Floors

Cracks, ruts and shallow holes less than 1/2 inch deep in concrete floors are readily repaired with a new product known as Smooth-On No. 7B Quick-Patch Cement, manufactured by the Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City, N. J. The composition has an iron base, so that it is wear-resistant, as well as dustproof, oilproof and waterproof. On hardening, the cement expands slightly, thereby securely wedging the patch within the cavity. Patches harden over night, and are ready for full traffic the next morning.....208

High Tensile-Strength Solder for Aluminum and Other Alloys

A special solder for the soldering of such metals as aluminum, aluminum alloys, Dowmetal, and Alnico has been developed by the Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago, Ill. This material is free flowing, and has a relatively high tensile strength. It retains a color similar to aluminum and Dowmetal, and is corrosion resistant. 209

Stop-Off Lacquer for Localized Hardening of Steel Parts

A stop-off lacquer for use in localized hardening of steel parts has been developed by the Michigan Chrome & Chemical Co., 6340 E. Jefferson Ave., Detroit, Mich. The use of this lacquer, designated as "Miccro Supreme," eliminates the handling and grinding operations ordinarily required before heat-treating to remove the copper-plating on those areas that are to be hardened.

In the simplified method afforded by this new stop-off lacquer, a coating is applied on the areas to be hardened before the part is copper-plated. After plating, which, because of the lacquer coating, only covers the areas to be left unhardened, the lacquer is removed and the pieces are ready for heat-treatment without further preparation. This lacquer is easily applied and removed, and its use requires no special skill or equipment. 210

Two New Durez Molding Compounds with High Impact Strength

Two new molding compounds have been recently announced by Durez Plastics and Chemicals, Inc., 1213 Walck Road, North Tonawanda, N. Y. One of these, No. 11540, is a general-purpose compound with high impact strength and a surface finish that retains its luster unusually well. Its water absorption (A.S.T.M.) is 1 per cent.

The other, No. 11934, is a macerated fabric-filled material with high impact strength for a phenolic material. Its curing time is good, although it cannot readily be preformed....211

To obtain additional information about materials described on this page, see lower part of page 158.

NEW TRADE LITERATURE

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 157 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the August Number of MACHINERY

Carbide Tools and Blanks

McKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Catalogue 42V, on Kennametal steel-cutting carbide tools and blanks. Typical applications are shown, and information is included on the selection and design of tools and blanks, chip breaker designs, correct grinding, boring tool set-ups, and other engineering data. Complete specifications and prices are given. 1

Welding and Fabricating Stainless Steel

REPUBLIC STEEL CORPORATION, Cleveland, Ohio. Booklet 373, containing complete information on the welding of stainless steel. Booklet 322-A, descriptive of the proper procedure for shearing, blanking, drawing, spinning, forming, machining, and otherwise fabricating Enduro stainless steels. 2

Carboloy Dies for Small-Arms Ammunition

CARBOLOY COMPANY, INC., 11147 E. Eight Mile St., Detroit, Mich. Bulletin D-113, covering standardized Carboloy dies for small-arms ammunition. The book also contains an operator training section, discussing the finishing and servicing of carbide dies. 3

Care of Grinding Wheels and Accident Prevention

STANDARD SAFETY EQUIPMENT CO., 232 W. Ontario St., Chicago, Ill. Folder entitled "Grinding Wheel Care and Safety," containing suggestions on the use and storage of grinding wheels, and instructions for preventing accidents. 4

Aircraft Production and Maintenance Equipment

LYON - RAYMOND CORPORATION, 976 Madison St., Greene, N. Y. Catalogue Section No. 6 entitled "The Answer to Production and Servicing Problems in the Aviation Industry," illustrating hydraulic hoists, spotting dollys, lift-trucks, portable cranes, elevating tables, etc. 5

Grinding Practice

NORTON CO., Worcester, Mass. Catalogue entitled "The ABC of O.D. Grinding," containing helpful information on cylindrical grinding and centerless grinding practice, including set-up of machine, selection of proper wheels, "tricks" that increase production, etc. 6

Tempering Equipment

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalogue T-625, entitled "Homo Method for Tempering," showing how this method is helping to overcome heat-treating bottlenecks, and giving data and charts relating to the process. 7

Metal-Parts Washer

STURDY-BILT EQUIPMENT CORPORATION, 1441 S. 65th St., Milwaukee, Wis. Circular descriptive of the "Sturdy-Bilt" Soaker-Hydro metal-parts washer for soaking, washing, drying, and preparing metal parts, either finished or rough, as well as complete metal assemblies. 8

Salvaging Tools By Welding

EUTECTIC WELDING ALLOYS, INC., 40 Worth St., New York City. Folder entitled "A New Welding Process to Speed Victory," giving data on actual savings obtained by salvaging tools and parts with Castolin Eutectic low-temperature welding. 9

High-Speed Steel

JESSOP STEEL CO., 605 Green St., Washington, Pa. Bulletin 242, containing data on the advantages and performance of the new Jessop TCM molybdenum-tungsten high-speed steel. Typical applications and heat-treating procedure are covered in detail. 10

Cleaning Materials

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Booklet 5562, covering all the essential phases of cleaning required in aircraft production and maintenance. Specific data is given for thirty-five cleaning operations. 11

Aero-Thread Screw Thread System

AIRCRAFT SCREW PRODUCTS CO., INC., 47-23 Thirty-fifth St., Long Island City, N. Y. Catalogue 5, containing specifications covering the Aero-Thread screw thread system for reinforcing tapped threads in light metals, such as aluminum, magnesium, etc. 12

Whiteprint Machines

OZALID PRODUCTS DIVISION, GENERAL ANILINE & FILM CORPORATION, Johnson City, N. Y. Booklet explaining the Ozalid process of making dry-developed, positive type whiteprints, and describing the outstanding features of the machines used. 13

Machinery and Tools

JEFFERSON MACHINE TOOL CO., 673-773 W. Fourth St., Cincinnati, Ohio. Circular illustrating and describing this company's line of precision milling machines and attachments, turret attachments for lathes, grinding and polishing machines, etc. 14

Spray Painting Equipment

E. I. DU PONT DE NEMOURS & Co., Wilmington, Del. Booklet entitled "How to Speed up Your Finishing Operations," explaining eleven factors that must be properly controlled in order to obtain the utmost efficiency in spray painting. 15

Precision Tappers

BRAND TOOL & SUPPLY CO., 344 N. Vermont Ave., Los Angeles, Calif. Bulletin 142, illustrating and describing the M & L No. 1 high-speed precision tappers. Leaflets descriptive of inside micrometers, telescope gages, and knurling tools. 16

Multi-Purpose Lathes

F. A. SMITH MFG. CO., INC., 98 Augusta St., Rochester, N. Y. Circular descriptive of Fasco multi-purpose stub lathes of simplified low-cost design, suitable for high-production precision work, especially on shells and other munitions. 17

Self-Locking Nuts

ELASTIC STOP NUT CORPORATION, 2330 Vauxhall Road, Union, N. J. Price list containing new reductions in price on the line of anchor, g a n g - channel, and instrument-mounting types of elastic stop-nuts made by this concern. 18

Chain Type Conveyors

RICHARDS - WILCOX MFG. CO., Aurora, Ill. Catalogue A-78, descriptive of a new chain type, production-line conveyor, showing typical installations and giving brief data on conditions under which application can be made. 19

Malleable-Iron Castings

BELLE CITY MALLEABLE IRON CO., Racine, Wis. Fiftieth Anniversary catalogue, describing the methods and facilities employed by this company in producing malleable-iron castings. 20

Grinders and Sanders

PORTER-CABLE MACHINE CO., Syracuse, N. Y. Circular illustrating and describing belt, disk, and spindle type grinders and sanders for use in tool-rooms and pattern shops, as well as on production work. 21

Maintenance of Electrical Apparatus

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Maintenance handbook, containing 220 pages of information intended to guide maintenance men in keeping electrical apparatus running. 22

Diamond Tools

J. K. SMIT & SONS, INC., 157 Chambers St., New York City. Booklet containing useful information on single-point diamond tools —their proper use and application, sizes, and prices. 23

Vertical Turret Mills

ROGERS MACHINE WORKS, INC., 125 Arthur St., Buffalo, N. Y. Bulletin 103, describing the features of construction of Rogers vertical turret mills for boring, drilling, and turning. 24

Blast Cleaning Equipment

PANGBORN CORPORATION, Hagerstown, Md. Circular containing performance data on a Roto-blast cleaning unit installed in a foundry for handling fragile parts. 25

Electric Equipment for Aircraft Production

GENERAL ELECTRIC CO., Schenectady, N. Y. Booklet GEA-3395, containing about two hundred photographs of electric equipment used in aircraft production. 26

Zinc in War

NEW JERSEY ZINC CO., 160 Front St., New York City. Third of a

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To Obtain Copies of New Trade Literature

listed on pages 156-158 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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City ..... *State* .....

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series of bulletins dealing with "Zinc in War," showing applications in the war industries. 27

Precision Tapping Machines

CLEVELAND TAPPING MACHINE Co., 1725 Superior Ave., Cleveland, Ohio. Pamphlet 7-42, illustrating and describing the new Cleveland Model D vertical automatic precision tapping machine. 28

Rubber Linings for Corrosive-Resistant Use

B. F. GOODRICH Co., Akron, Ohio. Catalogue Section 9000, on Vulcalock rubber linings for use in handling corrosives. 29

Seamless-Steel Tubing

SUMMERILL TUBING Co., Bridgeport, Montgomery County, Pa. Circular on the use of Summerill seamless-steel tubing for shotgun magazines. 30

Fatigue of Metals

NITRALLOY CORPORATION, 230 Park Ave., New York City. Second edition of a booklet entitled "Fatigue of Metals—Some Facts for the Designing Engineer." 31

Roller Bearings

BOWER ROLLER BEARING Co., 3040 Hart Ave., Detroit, Mich. Circular descriptive of the special features of the Bower precision roller bearing. 32

Recording Thermometers

BRISTOL Co., Waterbury, Conn. Bulletin T302, on Bristol fully compensated liquid-filled recording thermometers for temperatures between — 125 degrees F. and + 400 degrees F. 33

Coolant Pumps

RUTHMAN MACHINERY Co., 1809-1823 Reading Road, Cincinnati, Ohio. Catalogue describing the construction and advantages of "Gusher" coolant pumps for machine tools. 34

Gear Lead Checker

MICHIGAN TOOL Co., 7171 E. McNichols Road, Detroit, Mich. Bulletin descriptive of the "Sine-Line" gear lead checker recently developed by this company. 35

Horizontal Broaching Machines

COLONIAL BROACH Co., 147 Jos. Campau, Detroit, Mich. Folder outlining the features of the Model HAS line of universal horizontal broaching machines. 36

Chromium Plating

UNITED CHROMIUM, INC., 51 E. 42nd St., New York City. Bulletin on applications of industrial chromium plating. 37

Used Machine Tools

MILES MACHINERY Co., Saginaw, Mich. Circular listing the used machine tools and equipment available through this company. 38

Aluminum Bronze

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 102, discussing "Aluminum Bronze as an Alternate for Tin." 39

Blackening Process

ALROSE CHEMICAL Co., Box 1294, Providence, R. I. Catalogue descriptive of the Jetal process of producing a black protective surface on ferrous metals. 40

Prevention of Dermatitis

E. F. HOUGHTON & Co., Philadelphia, Pa. Circular discussing the prevention of dermatitis in the metal-working industry. 41

DoAll Surface Grinders

SAVAGE TOOL Co., Savage, Minn. Bulletin containing complete specifications covering the DoAll precision surface grinders. 42

Welding-Cable Connectors

DALLETT Co., 165-189 W. Clearfield St., Philadelphia, Pa. Circular covering Dalweld detachable welding-cable connectors. 43

Vacuum Pumps

F. J. STOKES MACHINE Co., Olney P. O., Philadelphia, Pa. Catalogue 38-P, descriptive of high-vacuum pumps. 44

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 159-178 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in August, 1942, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 154-155, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in August, 1942, MACHINERY.

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[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Baldwin Southwark Horizontal Hydraulic Double-Acting Draw Press

A 76-ton horizontal hydraulic double-acting draw press has recently been completed by the Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa. This huge press has a piston diameter of 14 inches, a piston-rod diameter of 9 1/2 inches, and a stroke of 87 inches.

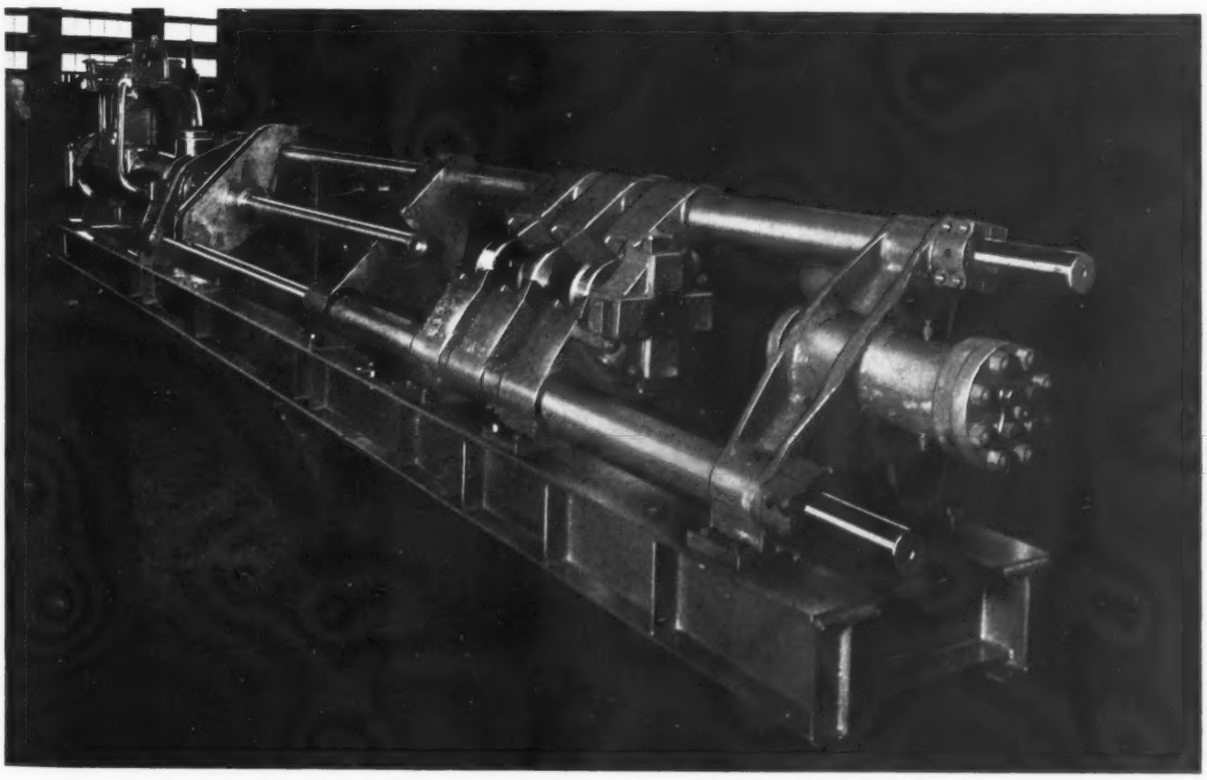
The press has two horizontal columns. The extreme end of the piston is supported by a well guided cross-head and adjustable shoes on the two columns. The drawing mandrel of the press is guided in a bronze-lined casting.

This hydraulic draw press is equipped with three adjustable die-heads and one stripper head. It may also be noted that the extreme end of the press is provided with a bumper cylinder. 51

"Staplbond" Cleaning and Polishing Brushes

In a new line of wire and Tampico brushes for cleaning, polishing, and finishing metals, developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J., fiber flanges are replacing steel to conserve metal, reduce shipping weight, and place less load on the spindles. These new brushes are designated as "Staplbond." The wire sections are made in sizes from 6 to 15 inches in diameter; the Tampico sections are made in sizes from 6 to 18 inches in diameter. Solid brushes are made in sizes ranging from 8 to 18 inches in diameter.

The steel wire section brushes are especially recommended for cleaning, polishing, and heavy brushing operations on steel, brass, and other metals, rubber, etc. The Tampico sections are intended for metal polishing and buffing operations. 51A



Baldwin Southwark 76-ton Horizontal Hydraulic Double-acting Draw Press

To obtain additional information on equipment described on this page, see lower part of page 158.

Shields Vertical Universal Milling Machine

The Shields Mfg. Co., Inc., 38-09 Twenty-fourth St., Long Island City, N. Y., has brought out a new model Vari-Angle milling machine designated the Shields No. 3 vertical. This machine is nearly twice as heavy as the Vari-Angle machine previously built, and has power feed and rapid traverse to the saddle and knee, as well as power feed to the spindle. It has been developed for use as a versatile tool-room machine and also as a production machine for boring, milling, and drilling on different faces of the work at one set-up.

The milling head can be set and clamped at any angle for such work as spiral milling. To change the angular position of the spindle in a longitudinal plane, the locking nut is loosened and the head swung into the new position by turning a handle attached to a worm in mesh with a worm-wheel on the milling-head drum. One turn of this handle indexes the head through an angle of 5 degrees. The head can be swung in the gooseneck holder by a similar arrangement operated by a handle, one turn of which indexes the head 10 degrees.

Push-button switches control all three motors of the machine. The feed motor cannot be started when the spindle is idle, and will stop automatically when the spindle stops. The spindle is driven by a 3-H.P. motor through a Reeves variable-speed pulley controlled by a handwheel, the speed being indicated by a dial. The drive is either direct or through hardened spiral gears, the back-gears and the clutch being engaged and disengaged by a single lever.

A four-speed sliding gear transmission is incorporated in the head for obtaining power feeds of 0.005, 0.007, 0.010, and 0.014 inch per revolution of the spindle. Directional control is provided for power feeds and rapid traverse movements in both forward and return directions. The machine weighs approximately 9000 pounds. 52

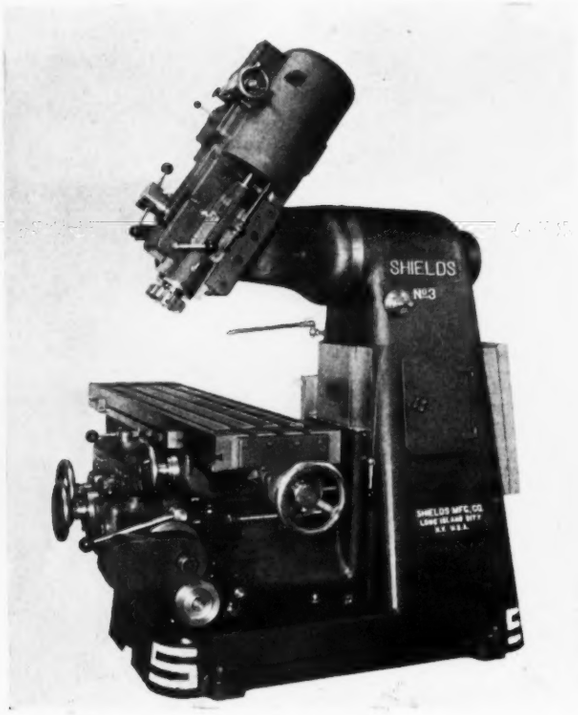
Lake Erie Press for Bending Heavy Plate

A 3000-ton hydraulic press designed for use in bending heavy plate has been brought out by the Lake Erie Engineering Corporation, Buffalo, N. Y. Relatively large pieces can be handled on the 168-by 53-inch bed of this press. The daylight space is 42 inches and the stroke 42 inches. Ram speeds range up to a maximum of 200 inches per minute for the approach, and 12 inches per minute for the pressing speed at a pressure of 3000 tons. The entire unit is self-contained, a 150-H.P. pump being located on top of the press.

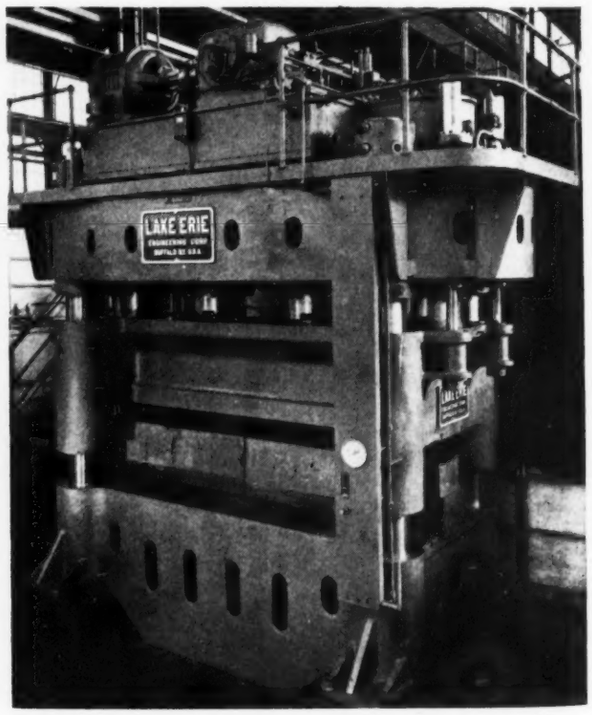
Extremely sensitive pressure control is provided by a hand-lever at the right-hand side of the press. A large-diameter, clear-reading pressure gage is mounted on the control panel. Pressure is applied uniformly across the upper platen by four large rams, and the platen is guided by unusually long hand-scraped guides. 53

Di-Acro Improved Bender and Brake

Important changes and improvements have been incorporated in the new Di-Acro bender and Di-Acro brake of the No. 2 series made by the O'Neil-Irwin Mfg. Co., Minneapolis, Minn. The weight and mechanical strength of the new models have been increased to obtain greater rigidity and stability.



Vertical Universal Milling Machine Built by the Shields Mfg. Co.



Lake Erie Press Designed for Heavy Plate-bending Operations

To obtain additional information on equipment described on this page, see lower part of page 158.

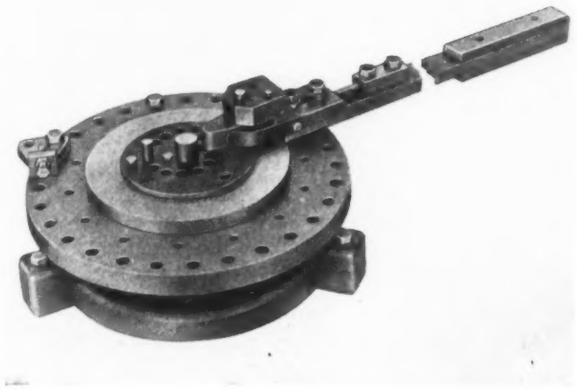


Fig. 1. Di-Acro Bender Adapted for Forming Round and Irregular-shaped Tubes

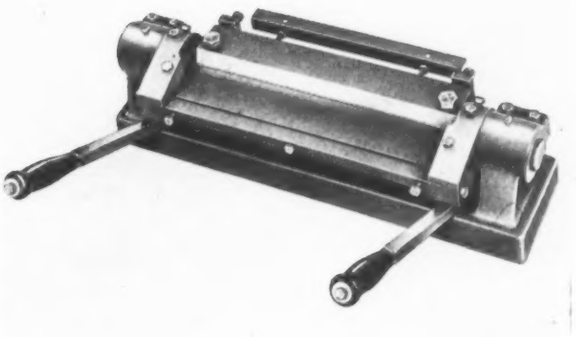


Fig. 2. Di-Acro Brake for Forming Materials Such as Synthetics and Dielectrics

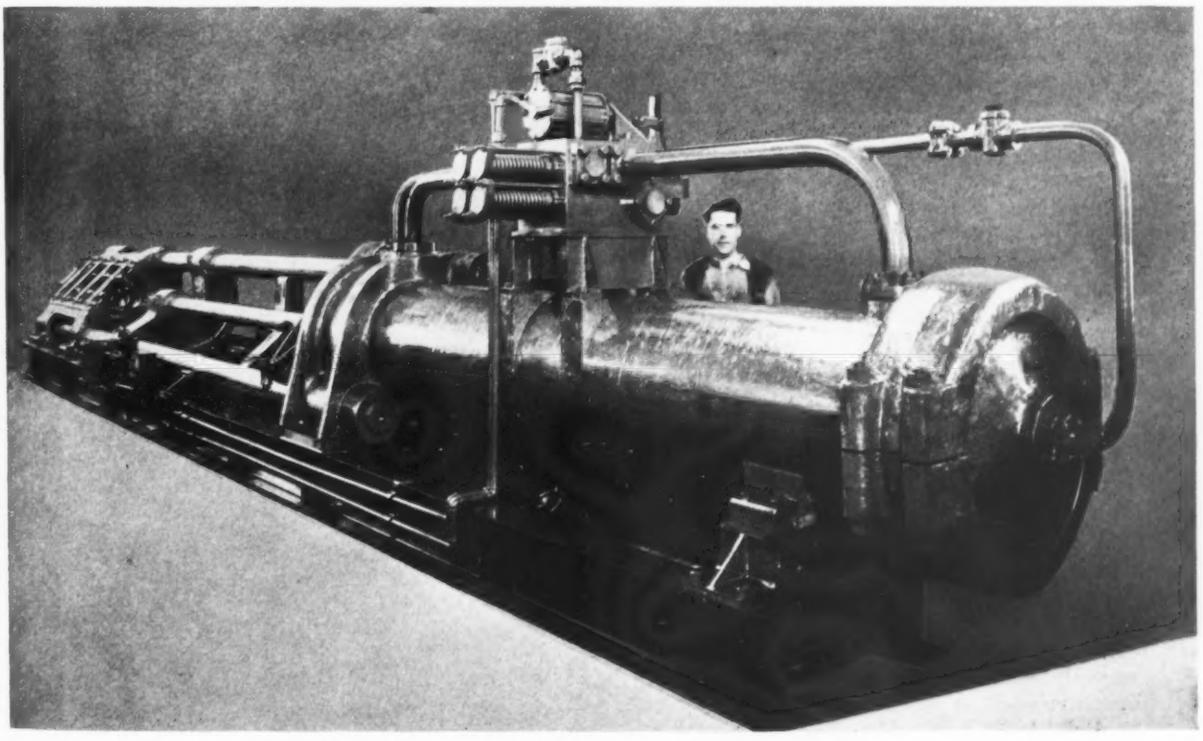
Changes in design have also been made which facilitate operation and increase production. The operating range and versatility have been broadened to permit economical forming and duplicating of a wide variety of parts without the expense of making special dies. 54

Baldwin Southwark Double-Acting Press for Drawing 155-Millimeter Shells

Approved for Publication by the War Department

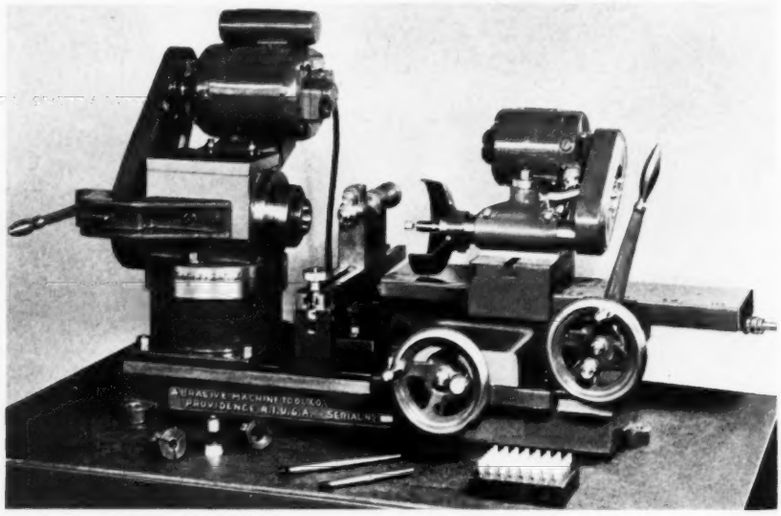
A horizontal hydraulic double-acting press of 200 tons capacity has been brought out by the Baldwin Southwark Division of the Baldwin Locomotive Works for use in the production of 155-millimeter shell forgings. This press is equipped with four die-heads and one stripper head. The extreme end of the piston is supported by a cross-head having adjustable shoes on the two columns of the machine.

The drawing mandrel extension is guided in a bronze-lined casting. The machine is mounted on a structural steel bed, and has the piping and four-way operating valve mounted on top of the cylinder. A pilot valve for operating the main valve is located in a convenient position. The press has a stroke of 11 feet, a piston diameter of 19 inches, and a piston-rod diameter of 14 inches. The floor space required is 45 by 6 feet. 55



Baldwin Southwark Shell-drawing Press of 200-ton Capacity

To obtain additional information on equipment described on this page, see lower part of page 168.



Internal Grinder for Tool and Die Work

New Internal Grinder Developed by Abrasive Machine Tool Co.

An internal grinder known as the Abrasive No. 1G has been developed recently by the Abrasive Machine Tool Co., East Providence, R. I., for use in large-volume manufacturing where a highly accurate, easily handled internal grinder is required for die and tool work. This machine will grind holes up to 12 inches in diameter. It has a longitudinal travel of 8 inches and a spindle cross-feed of 3 1/2 inches. The cross-feed is provided with a handwheel graduated to 0.001 inch. The longitudinal feed has a similarly graduated handwheel and is provided with a positive stop having a micrometer adjustment to facilitate accurate setting.

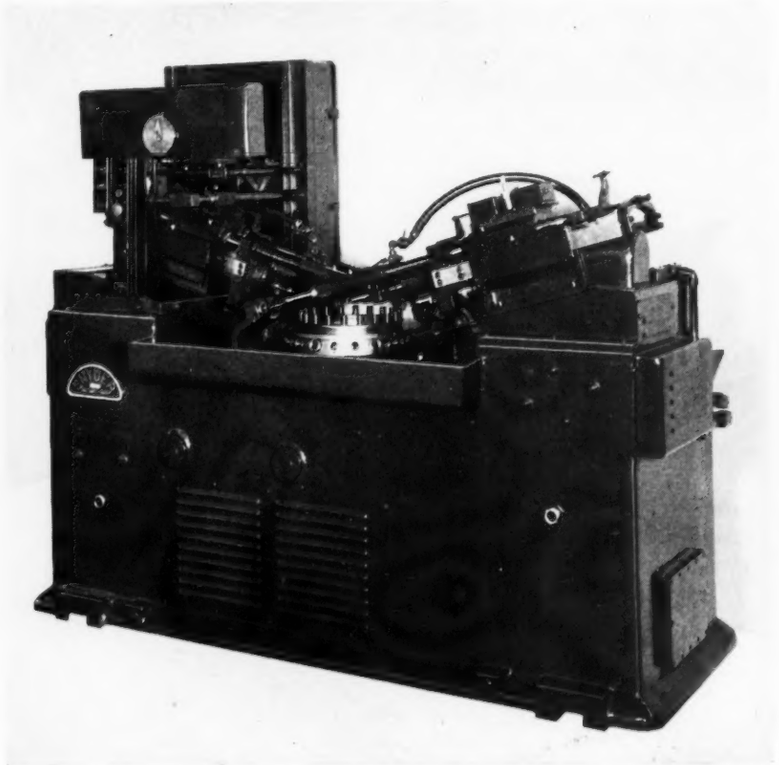
A rapid-acting draw-in collet and a quick-operating hand feed are features of this grinder. It can be used for external or cylindrical grinding within its capacity range, as well as for internal grinding. The work-spindle is graduated, and can be swiveled to permit grinding tapers up to 90-degree included angle. Four speeds are provided for the work-spindle as follows: 76, 145, 282, and 540 R.P.M. The work-spindle motor is of 1/4 H.P. The draw-in collet has a quick release attachment. The truing device is so designed that it can be swung away from the grinding wheel when not in use.

A Dumore 1/2-H.P. motor-driven precision wheel-spindle gives six speeds of 4600, 6500, 8600, 14,600, 32,500, and 42,500 R.P.M., providing the proper speeds for grinding wheels from 1/8 inch to 5 inches in diameter. The full-load speed of the motor is 10,000 R.P.M. The space required for the machine is 45 by 28 inches. The weight of the complete machine is approximately 550 pounds. 56

Snyder Special Hydraulic Drilling Machine for Gear-Carrier Ring

A special hydraulic drilling machine designed for drilling forty oil-holes 0.078 inch in diameter diagonally through the trunnions of a reduction-gear carrier-ring at each cycle, has been developed by the Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit, Mich. The machine consists of three main parts—the fixture table and indexing mechanism, and two hydraulically operated drill units. Hydraulic cylinders operating in conjunction with a Geneva indexing mechanism provide shockless rotation of the table, with smooth acceleration.

The drill spindles are ball-bearing mounted in a two-spindle head, and are equipped with bushing plates with overhanging guide pins. The two-spindle head is mounted in a hydraulically operated quill, and is driven by an electric motor on the inside of the base through V-belts and splined shafting. Accurate alignment of the small drills is insured by bushing plates and a pair of guide bars.



Snyder Hydraulic Drilling Machine Equipped for Drilling Holes Diagonally through Carrier-ring Trunnions

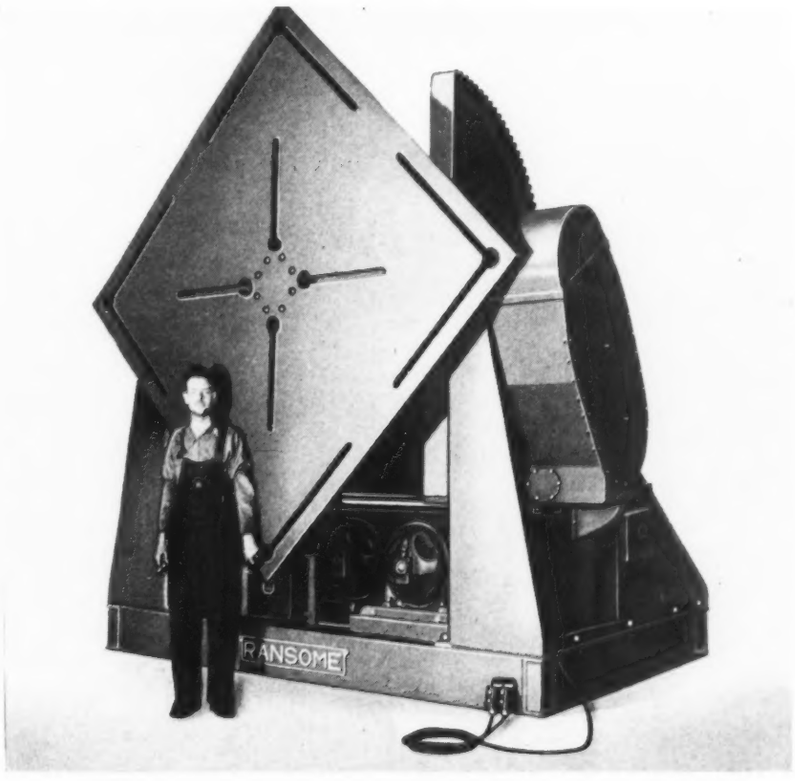
To obtain additional information on equipment described on this page, see lower part of page 158.

The work cycle of the machine is semi-automatic: After loading and manually clamping the work-piece, the cycle is started and the machine proceeds through twenty indexing motions, which complete the work. The entire cycle takes only six minutes. The electric control mechanism at the left rear of the machine includes a tell-tale dial which shows the operator at which part of the automatic cycle the machine is operating. In case of tool breakage or if an extremely dull tool is used, the machine is shut off automatically through limit switches. After a defective tool has been replaced, the work can be continued from the point at which it was interrupted. 57

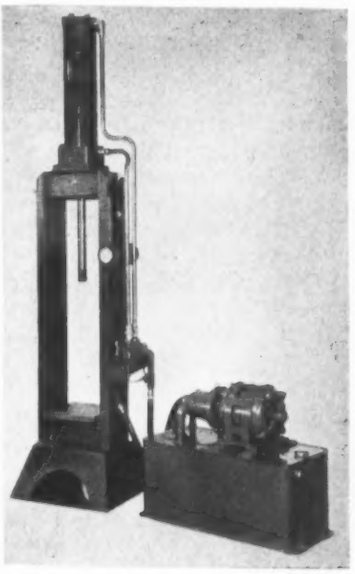
Ransome Heavy-Duty Welding Positioner

A 20-ton capacity heavy-duty unit has recently been added to the line of welding positioners made by the Industrial Division of the Ransome Concrete Machinery Co., Dunellen, N. J. The machine will handle a maximum load of 22 1/2 tons with the center of gravity 12 inches above the table top, tilting it to any position through a range of 45 degrees from horizontal in one direction to a vertical position in the other, and will rotate a similar load in which the center of gravity is located 12 inches from the center of the table top in a horizontal direction. The 84-inch square steel table top is machined, reinforced by ribs on the under side, and provided with four radial and four longitudinal T-slots for attaching work to the top surface. The heavy base frame is of all-welded construction.

The table can be rotated a full 360 degrees at a speed of 1/3 R.P.M. in either direction from a remote push-button control station. The two tilting gear segments provide a means for tilting the load uniformly, even when an unbalanced load is being handled. Tilting and rotating can be accomplished simultaneously, as separate driving motors are employed. The V-belt drives between motors and gear-reduction units are used because of their ability to absorb shock loads due to sudden changes from forward to reverse operation. 58



Ransome 20-ton Positioner for Tilting Work to Desired Angle for Welding



Long-stroke Press and Hydraulic Power Unit Brought out by Hydraulic Machinery, Inc.

Long-Stroke Press of 25 Tons Capacity

A hydraulic press designed for a specific purpose, but adapted for a broad range of industrial applications, has been announced to the trade by Hydraulic Machinery, Inc., 10421 Grand River, Detroit, Mich. The press has a capacity for exerting a pressure of 25 tons; a stroke of 30 inches; daylight space of 60 inches; closing speed of 4.4 inches per second; high-pressure speed of 0.8 inch per second; opening speed of 5 inches per second; a combination pump and relief, check, and unloading valve; a 7 1/2-H.P., 1200-R.P.M., three-phase, 60-cycle motor; manually operated control valve for controlling the direction of the ram movement; and a pressure gage having a capacity for indicating pressures ranging from 0 to 3000 pounds per square inch, which is located at a convenient height for quick reading.

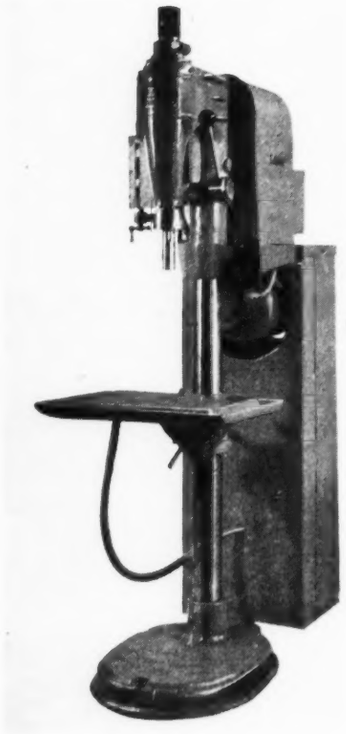
This press is of welded steel construction. It is mounted on a flared base 30 by 30 inches, and has an over-all height of 139 inches. The distance from the floor to the platen is 25 inches, and the size of the platen is 18 by 18 inches. The hydraulic power unit which has been developed for use with this machine, and which is shown adjacent to the press, can be installed in a separate room or building if desired. 59

To obtain additional information on equipment described on this page, see lower part of page 158.

Cleveland Tapping Machine with Lead-Screw Control

The Cleveland Tapping Machine Co., 1725 Superior Ave., Cleveland, Ohio, has brought out a new Model D lead-screw type tapping machine that is fully automatic in operation. The direction of spindle rotation can be controlled by a push-button, and the spindle can be stopped in any position and started again in either direction. The depth stop-gage is so sensitive that the reversal of the spindle is controlled within two cycles, and the vertical travel of the spindle can be adjusted to the exact depth desired by means of a visible indicator on the faceplate. This arrangement makes the machine especially adapted for bottom tapping.

The sensitive clutch can be instantly adjusted for tapping a 10-32 National fine or a 3/4-inch National coarse thread. This feature is made possible by the smooth operation of the bi-metallic clutch disk. The lead-screw assembly is mounted on top of the housing, while the lead-screw nut is fastened directly to the spindle, which is 1 3/4 inches in diameter. The tapping of Class 3 fit threads is a simple production job with this equipment. The 1/2-inch size machine is equipped with a 1-H.P. motor, and the 1-inch size has a 2-H.P. motor. The V-belt drive provides spindle speeds of 275, 375, 475, and 600 R.P.M. 60



Cleveland Lead-screw Type Tapping Machine

New Stellite Alloy for Machining Steel

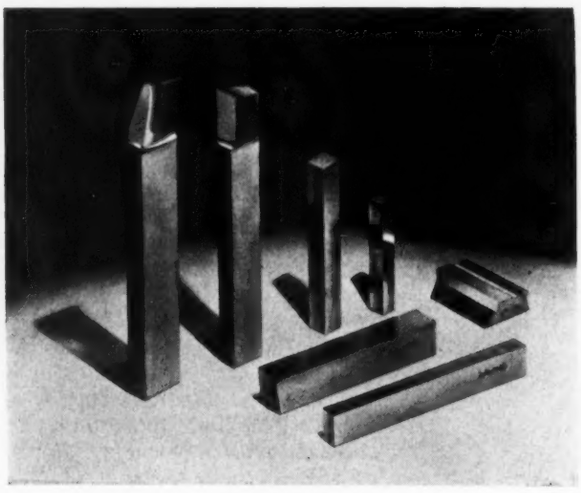
The Haynes Stellite Co., Kokomo, Ind., has just brought out a line of Stellite 98M2 tools made of a new cobalt - chromium - tungsten alloy. This alloy is designed especially to permit higher cutting speeds in the production machining of steel, and was developed by the Haynes Stellite Co. in cooperation with the Union Carbide and Carbon Research Laboratories, Inc. It has been adopted for a large variety of machining operations on steel parts as a result of extensive production tests on many types of steel. The new tools, examples of which are shown in the accompanying illustration, will machine steel at even higher cutting speeds than Stellite Star J-Metal or 2400 tools, and have a longer life between grinds.

Heavy roughing cuts can be taken with 98M2 tools on steel turning jobs with coarse feeds that give high rates of metal removal. The long and economical life of these tools is attributed to the well balanced red-hardness, edge strength, and toughness of the new alloy. The tools are especially adapted for such operations as turning, facing, boring, reaming, milling, grooving, cutting off, forming, spot-facing, core-drilling, and counterboring.

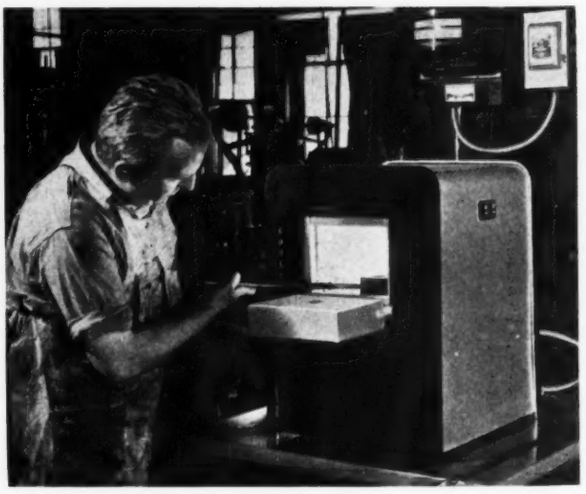
These tools are now available in standard square and rectangular solid bits and in twenty standard styles of welded-tip tools of various sizes for turning, facing, and boring. Special tools, including solid bits or brazed-tip styles for grooving or forming special contours, are also being made. 61

Cooley Electric Heat-Treating Furnace

The Cooley Electric Mfg. Corporation, 215 S. Senate Ave., Indianapolis, Ind., has developed a small



Stellite Alloy Tools Designed for High Cutting Speeds in Machining Steel



Cooley Electric Muffle Furnace Designed for Heat-treating Small Parts

To obtain additional information on equipment described on this page, see lower part of page 158.

electric muffle furnace for economical and fast heat-treating of small parts, drawing or tempering small lots of small parts, normalizing or annealing, preheating for subsequent high-speed hardening, and emergency repair work, where one or two small parts must be heat-treated in a short time. It can also be used as auxiliary equipment in the operation of furnaces of larger sizes.

The furnace is built in two sizes. The Type MH-3 has a chamber 8 inches wide by 6 inches high by 14 inches deep, measures 18 by 22 by 23 inches on the outside, and has a maximum power consumption of 3400 watts. The Type MH-4 furnace has a chamber 10 inches wide by 6 inches high by 18 inches deep, measures 18 by 22 by 27 inches on the outside, and has a maximum power consumption of 4800 watts. Operating temperatures are 1750 degrees F. for continuous operation, and 1850 degrees F. for intermittent use.

The Type MH-3 furnace operates on both 110- and 220-volt circuits, whereas the Type MH-4 is available for 230-volt circuits only. These furnaces are available with either automatic or hand control, although the use of the former is recommended. 62

P & W Deep-Hole Drill Sharpening Attachment

A deep-hole drill sharpening attachment with a capacity for grinding drills from 5/8 inch to 2 inches in diameter has been brought out by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. This attachment was developed for sharpening single-lip drills with straight or helical chip grooves.

Selective cam action on this sharpening attachment makes it possible to maintain accurately predetermined drill tip angles, and at the same time, provide clean, sharp cutting edges. It can be clamped on the standard table of a universal cutter grinder or on other grinders of similar design. Although developed primarily for sharpening step type drills, it can also be used for sharpening V-shape drills or other cutting tools of similar shape.

The drill to be sharpened is located by keys in the spindle, which is made hollow to accommodate drills of any length, with or without shanks. A cylindrical cam attached to the rear of the spindle has three different cam grooves. The desired cam action is obtained by the insertion of a removable cam roller in the proper groove. A 1/8- to 1/4-H.P. two-speed motor serves to drive the spindle or it can be rotated manually, depending upon the particular sharpening job.

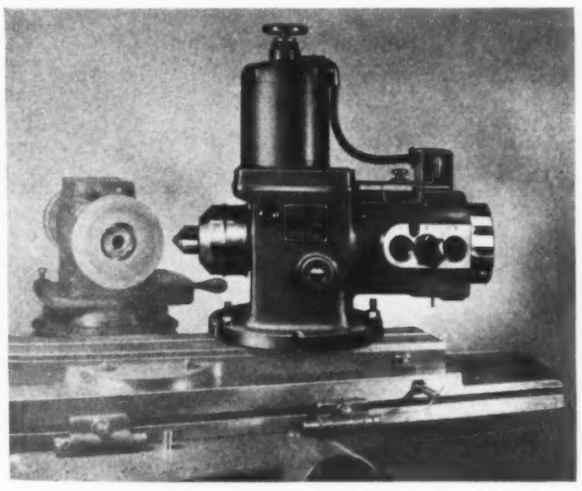
It is claimed that drills sharpened by this attachment cut freely and produce clean, accurate holes at a high production speed. The attachment is 20 inches long, 14 1/2 inches wide, 20 inches high, and weighs approximately 200 pounds. 63

Falcon Electric Muffle Furnace

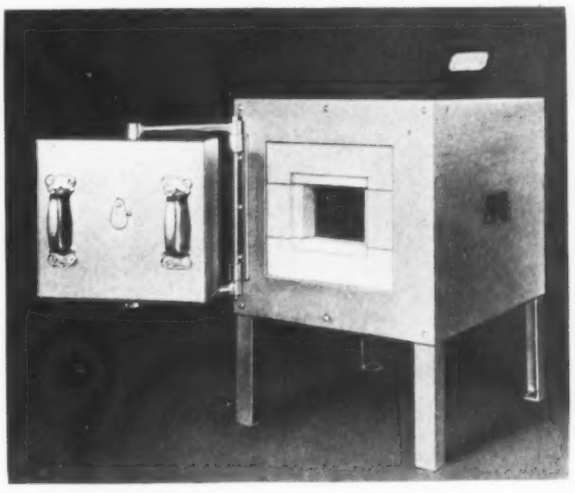
The Falcon line of electric furnaces manufactured by H. O. Swoboda, Inc., 130 Thirteenth St., New Brighton, Pa., has recently been augmented by a new full-muffle, electric, box type furnace with an all-refractory hearth. This furnace, designed to operate at temperatures up to 2000 degrees, is adapted for heat-treating high-speed tool steels, hardening, tempering, and many other tool-room and laboratory heating applications. The principal features include long operating life at maximum temperature and quick heating, maximum temperature being obtained in less than one hour after the furnace has been started.

A new type center-pivoted door eliminates the mechanism and consequently much of the cost of the standard sliding door. This door has the advantage of always swinging away from the workman and thus shielding him from exposure to the heat of the inner door surface. The heating chamber is 3 3/4 inches high, 5 1/4 inches wide, and 12 inches deep.

The furnace shown is arranged for bench mounting, but is available in a floor type. It has a capacity of 3 kilowatts and can be furnished for operation on 110- or 220-volt, single-phase current. An indicating pyrometer is furnished, and automatic temperature controls are supplied, either mounted directly on the furnace or with separate mounting. 64

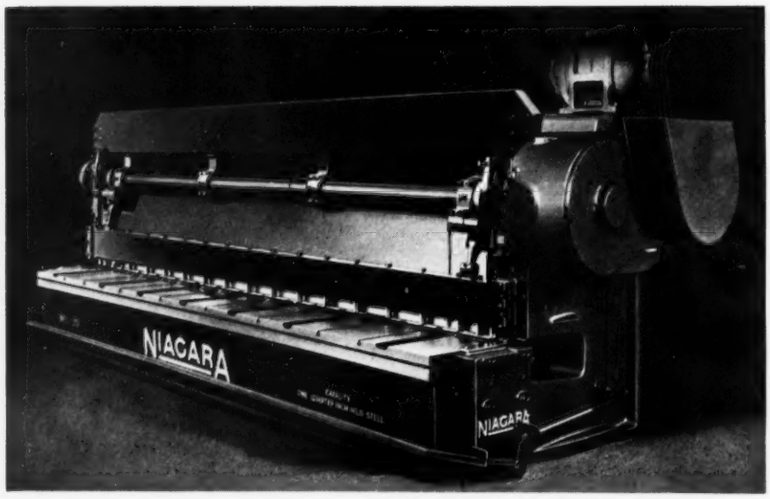


Pratt & Whitney Attachment for Sharpening Deep-hole Drills



Falcon Electric Muffle Furnace Made by H. O. Swoboda, Inc.

To obtain additional information on equipment described on this page, see lower part of page 158.



Niagara Power Squaring Shear with Capacity for Cutting 20-foot Lengths

Niagara Power Squaring Shears

A new power squaring shear of long-length capacity has been added to the Series L line made by the Niagara Machine & Tool Works, 637-97 Northland Ave., Buffalo, N. Y. This shear has a regular cutting-length capacity of 20 feet; but by utilizing the gap in the housings, even longer sheets can be squared, trimmed, and slit.

The massive bed and housings, together with the triangular-section cross-head of the press, have been designed to maintain the straightness and correct clearance of knives throughout the cutting length. Convenient operation and quick gaging features are provided to speed up the handling of stock and to reduce operator fatigue.

The self-measuring ball-bearing parallel back-gage measures in increments of 1/128 inch. Full visibility of the cutting line facilitates cutting to a scribed line. The drive mechanism operates on anti-friction bearings, and is completely enclosed in an oil-tight case. 65

Wagner Templet Duplicator

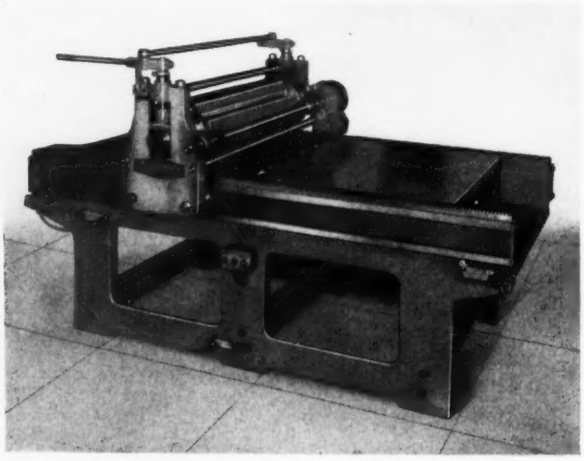
A templet-duplicating machine similar in general construction to a proof press used in printing has been brought out by the Charles Wagner Litho. Machinery Co., 51 Park Ave., Hoboken, N. J. This duplicator takes a scribed sheet-metal master templet, such as is used in aircraft manufacture, and prints an impression of it on a duplicate sheet. The duplicate impression is black, with all scribed lines appearing in white. Any number of duplicates can be made in this way.

In operation, the master templet is secured in position on the bed at the right of the machine and then coated with ink by a hand-roller. Next, a push-button is pressed, causing a motor-driven printing-roll assembly to advance and take an impression from the master, which is deposited on a duplicate sheet held on the bed at the left. This transfer operation is accomplished by means of a rubber blanket attached to the printing roll.

The master bed can be adjusted to accommodate sheets up to 1/4 inch thick, and the duplicate bed will take any thickness up to 1 inch. The bed size is 48 by 84 inches, larger templets being printed in two operations, which gives the equipment a capacity of 144 inches. A hand-crank is provided for operating the equipment in the event of power failure. 66

Challenge Abrasive Cut-Off Machine

An abrasive cut-off machine is being manufactured by the Challenge Machinery Co., Grand Haven, Mich., for cutting any hard or soft metal, including hardened tool steel. The machine is adapted for cutting either tubular or solid



Templet-duplicating Press Made by Charles Wagner Litho. Machinery Co.

Abrasive Cut-off Machine Manufactured by the Challenge Machinery Co.

To obtain additional information on equipment described on this page, see lower part of page 158.

HASTENING

THE MANUFACTURE OF BROWN & SHARPE MAGNETIC CHUCKS

-- to give Industry the many advantages of our Permanent Magnet Type

FIVE RECTANGULAR MODELS – 2½" x 5" to 12" x 36"

ROTARY MODEL – 9" Diameter

- NO WIRES
- NO HEATING
- NO OPERATING COSTS

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.

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For sale only in the U. S. A. and its Territories

BROWN & SHARPE

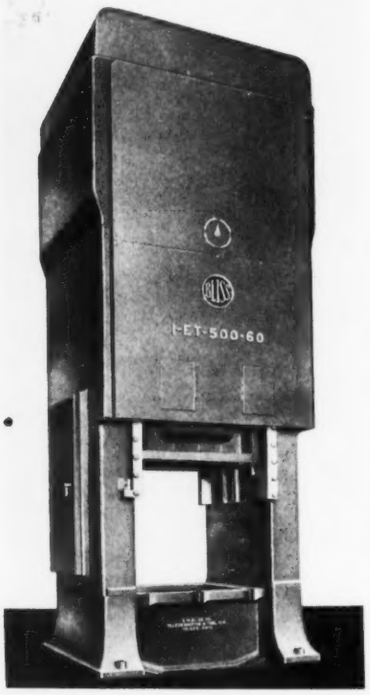
pieces in sizes up to 1 inch in diameter, and has an adjustable table 15 by 14 inches.

It is equipped with an elastic cut-off wheel 6 inches in diameter by 1/32 inch thick, having an arbor hole 1/2 inch in diameter. An adjustable safety guard is provided above the wheel to protect the operator's eyes. The belt at the side is also guarded. An adjustable miter gage is included for use in cutting-off operations. Power is obtained by plugging into any light socket. The base is made of cast iron. An all-steel stand, 16 by 22 by 34 inches, is available. 67

Bliss Enclosed Type Toggle Press

A new line of enclosed one-point, double-action, toggle drawing presses has been developed by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. These presses can be built with practically any pressure capacity, length of stroke, or die space required.

Like the older types, the new toggle presses are designed for use in the manufacture of seamless cooking utensils, brake-drums, automobile radiators, sinks, tubs, etc. The frames are of the conventional four-piece steel tie-rod design.



Enclosed Type Toggle Press Developed by the E. W. Bliss Co.

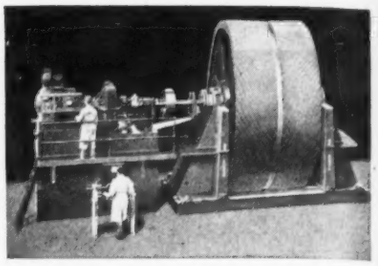
Provision can be made for disconnecting the toggle mechanism from the blank-holder and attaching the outer slide to the inner slide, which is operated in the usual manner, thereby converting the presses into single-action machines and adapting them for such blanking and forming operations as come within their capacities.

The presses can also be easily converted for triple-action operation by fitting pressure attachments into the beds. They can also be fitted with synchronized mechanical third motion in the bed for work that requires a machine of the latter type. 68

"Gilbarco" Centrifugal Coolant Pumps

The Gilbert & Barker Mfg. Co., West Springfield, Mass., has brought out two new "Gilbarco" coolant pumps designated Models CE and CF. The Model CE centrifugal pumps are designed particularly for grinding operations, and are recommended for the handling of any coolants which may become contaminated with abrasives. They are manufactured with three different heights of pedestals for sump or tank mounting. Although not regularly equipped with mounting brackets, these can be supplied at small cost. The motor, pump, and terminal box are a compact integral unit. The motor, of 1/4 H.P., is totally enclosed to protect it from dirt or vapor, and from short-circuiting due to splashing liquids. It is designed for continuous operation without overheating. The capacities of the Model CE pumps range from a fraction of a gallon to approximately 21 gallons per minute. No by-pass or relief valves are required when using retarded rates of flow.

The Model CF flange-mounted coolant pumps are built for use in all machining operations with the exception of grinding. No inlet piping is required, and they are easily installed on milling machines, turret lathes, or other machine tools by means of four bolts which pass through the heavy vertical mounting flange. A 1/4-H.P. enclosed motor is used with this pump also. Any commercial coolant can be circulated with these pumps in quantities ranging from a fraction of a gallon to approximately 17 gallons per minute. 69



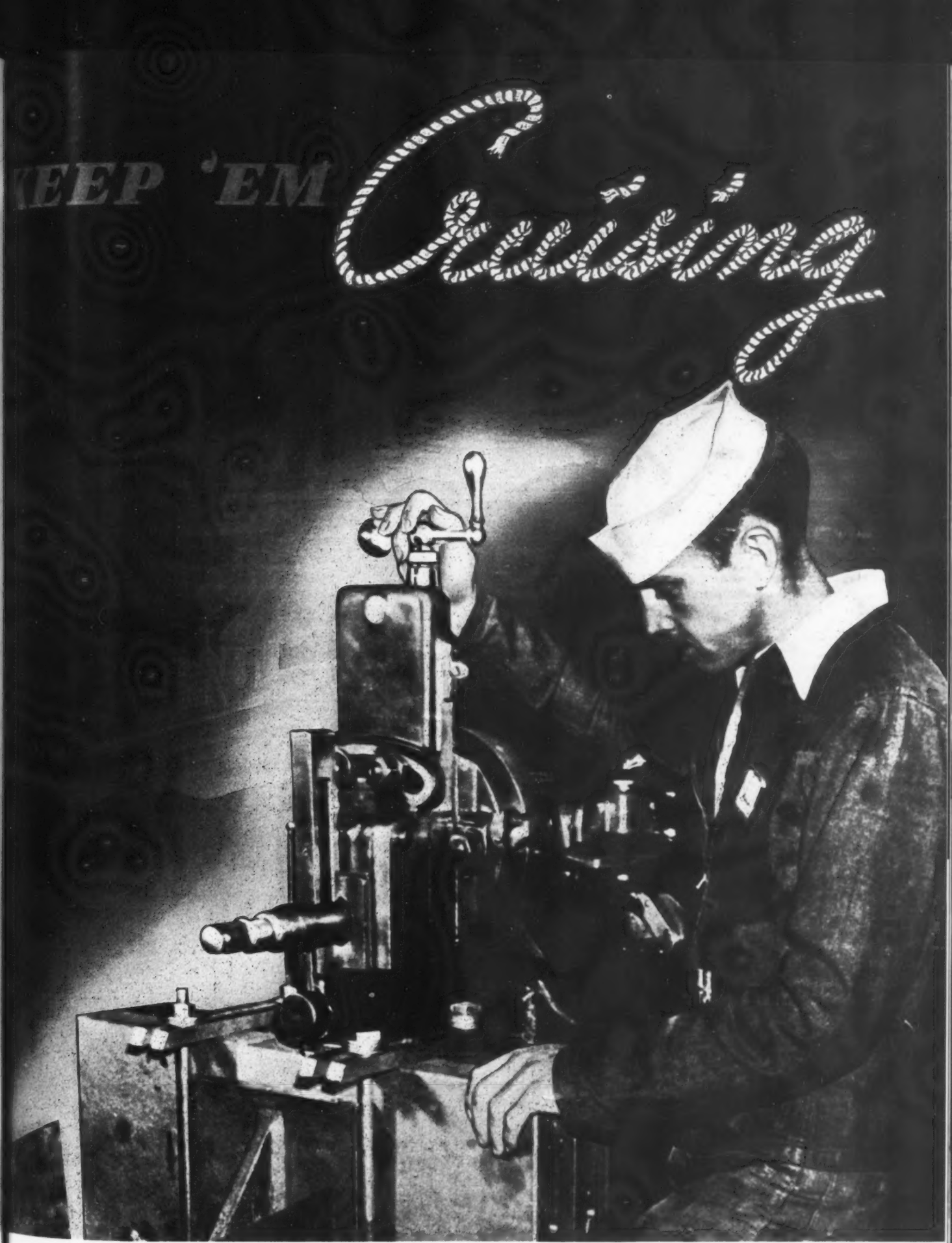
Machine Set up for Balancing a 50-ton Reduction Gear

Gisholt Balancing Machine

The Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis., has recently added to its line a new floor type Dynetric balancing machine, built for balancing parts up to 100,000 pounds in weight. This machine has a 200-inch swing, and will take parts up to 240 inches long. The Gisholt Type S Dynetric, which is the smallest of the line, is now available for balancing parts weighing as little as 1 ounce. Thus, this complete line of machine covers a range of balancing capacities from 1 ounce to 50 tons. The machine shown is being used for balancing a marine reduction gear 16 feet 8 inches in diameter, 7 feet 4 inches face width, and weighing 50 tons. 70

"Gilbarco" Model CE Immersion Type Coolant Pump

To obtain additional information on equipment described on this page, see lower part of page 158.



CINCINNATI SHAPERS, ashore and afloat, are helping to build and to maintain our battle fleets.

THE CINCINNATI SHAPER CO. • CINCINNATI, OHIO

OFFICIAL U.S. NAVY PHOTO

"Tandem Timer" for Controlling Operation Cycles in Laboratories and Production Departments

"Tandem Timer" for Laboratory and Production Work

A timing device known as the "Tandem Timer," developed particularly to facilitate the work of production departments and laboratories, and for testing the life of electrical apparatus, has been brought out by the Industrial Timer Corporation, 113 Edison Place, Newark, N. J. This device permits using practically any timing sequence desired. It is essentially a control unit with two individual and variable plug-in type timing elements, as shown in the illustration. With the timing elements adjusted to their correct respective time intervals, each cycle of operation will follow the other continuously.

When the dials have been set at the time interval desired, further adjustments are unnecessary until a new timing sequence is required. The automatic reset features of this timer makes possible a continuous, as well as a single cycle of operations. Plugging in of different timing elements can be accomplished in a few seconds. The timer is available in six standard models that enable setting ranges of from 1/4 second to 2 hours 45 minutes to be used. Timers can, however, be built to specifications for longer time cycles. 71

Multi-Speed Grinder

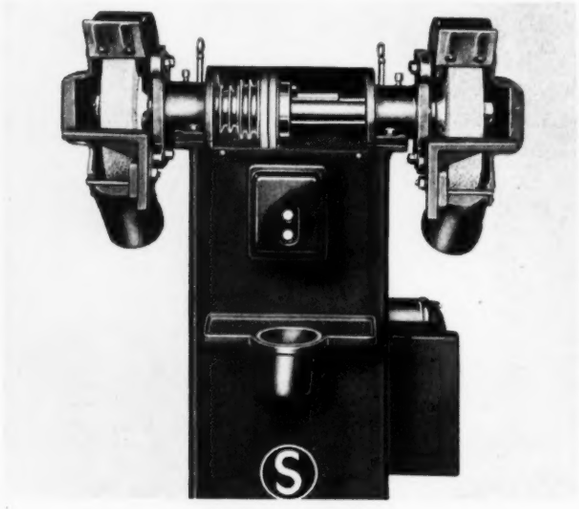
The Standard Electrical Tool Co., 1938 W. 8th St., Cincinnati, Ohio, has added to its line a multiple-speed grinder which has the advantage of being able to use wheel stubs, or wheels from larger machines which have been worn down and discarded.

This grinder permits a wheel 12 inches in diameter to be operated at the correct peripheral speed until it has been worn down to a diameter of 5 inches. The ball-bearing, totally enclosed motor is mounted on an adjustable plate at the rear of the pedestal. Power is transmitted to the grinding spindle from the motor through a multiple V-belt drive. A push-button safety starter is located at the front of the machine. Other multiple-speed grinders are available for use with vitrified or high-speed wheels in sizes up to 30 inches in diameter. 72

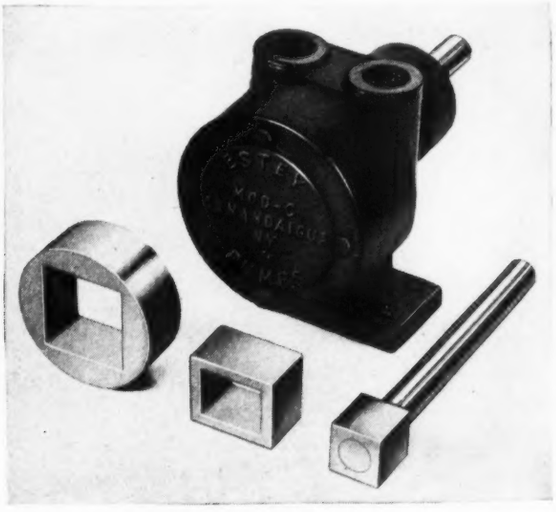
Estey Coolant Pump

The Estey Pump Co., Inc., Canandaigua, N. Y., has just placed on the market a Model C coolant pump designed to pump either thin or thick coolants without requiring priming each time the machine is started up. This pump has only three moving parts, as shown in the illustration. These three parts are so arranged that the pumping action is obtained by the equivalent of practically four pistons operating within a circular area.

The pumping action is positive, and the pump can be operated in either direction. Two of the moving parts, made of similar metal, are separated by the third part, which is of a different metal. This feature tends to reduce friction and thus lengthen the life of the pump.



Multi-Speed Grinder Brought out by the Standard Electrical Tool Co.



Coolant Pump with only Three Moving Parts, Built by Estey Pump Co.

To obtain additional information on equipment described on this page, see lower part of page 158.

THE SUPER SERVICE RADIAL

Here's a well-known Machine Tool, well-known for its rapid, low cost, high precision, quality work! The features of the Super Service Radial make this machine ideal for war-production plants where continued service for 24 hours a day, 7 days a week, is routine practice. The Super Service Radial is illustrated above, set up for line-reaming landing gear trusses, at one of the Douglas Aircraft plants. This job calls for extreme accuracy; two trusses are located in the jig by means of plugs inserted through reamed holes to maintain in-line accuracy of both parts. Consistently accurate performances of this nature are characteristic of the Super Service Radial. List of features will be sent upon request.

SUPER SERVICE

THE CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO, U. S. A.

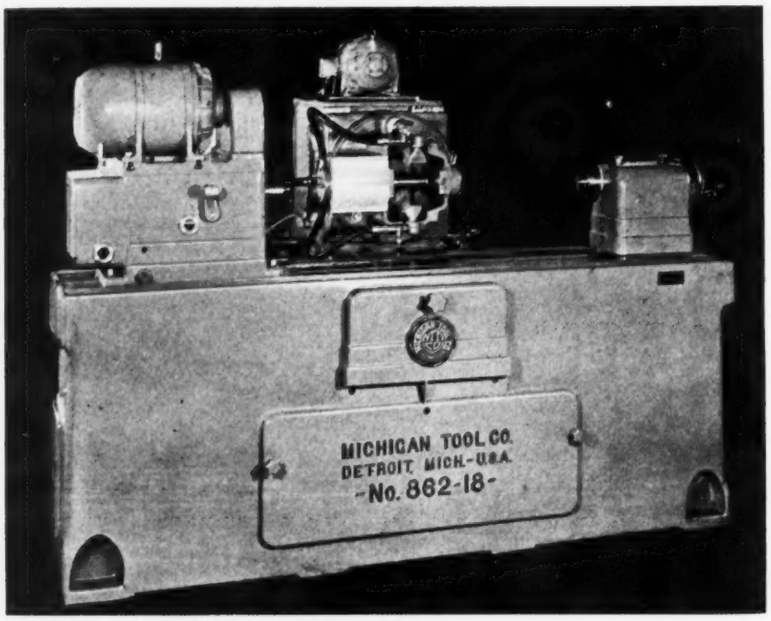


Fig. 1. Michigan Series 862-18 Gear-finishing Machine

Another feature is the ease with which the pump can be taken apart for cleaning without disturbing the mounting or piping. The pump has a capacity for pumping from 3 to 12 gallons per minute at speeds of 300 to 1200 R.P.M. The ports are tapped for 3/4-inch pipe thread. The pump has a standard S A E base, 2 1/4 by 4 inches. 73

Michigan Gear-Finishing Machines

An entirely new series of heavy-duty, crossed-axis, gear-finishing machines for finishing gears up to 24 inches in diameter has been brought out by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. These machines, designated Series 862-18 (Fig. 1) and 862-24 (Fig. 2) are adapted for finishing gears used in speed reducers, machinery of various types, large engines, turbines, etc. Gears as small as 2 1/4 inches in diameter and as large as 24 inches in diameter, with face widths up to 20 inches, can be finished on these machines. The machines will accommodate gears mounted on long or large-diameter shafts.

Three different methods of gear-finishing can be used, depending on the type of gear, its face width, diameter, and the length of the gear-shaft. In all three methods, however, the work serves to drive the cutter, with which it meshes. The first method is particularly suited for finishing wide-faced gears; the cutter, in addition to having an in-feed toward the gear, is also reciprocated in a line parallel to the axis of the gear.

The second method is used for quick finishing of gears having a narrower face width than the cutter, and also for cases where close shoulder work is required. The slide, in this case, is set in a vertical position, the cutter, however, being in the same crossed-axis relationship to the gear as in the first method. The in-feed is not used, but the cutter-head is located in such a manner that the axis of the cutter and the axis of the gear, when viewed vertically, are at the proper distance apart for the correct sizing of the gear. The gear is placed on the machine lightly meshed with the cutter. The machine is then started and the cutter moves down till it has reached the maximum depth of cut, after which it returns to its starting position, completing the machine cycle.

The third method represents a combination of the first and second methods. The cutter-slide is located in the vertical position, and in-feed is used, the cutter-head reciprocating vertically instead of horizontally as in the first method. Thus the gear is finished by a number of vertical passes instead of one pass, as in the second method. Any amount of in-feed can be used. The in-feed is automatically terminated by a limit switch.

Provision is made to permit crowning the gears, when desired. This practice is sometimes employed to avoid unduly high localized tooth loading at the outer ends of gear teeth due to possible inaccuracies in the final assembly. ... 74

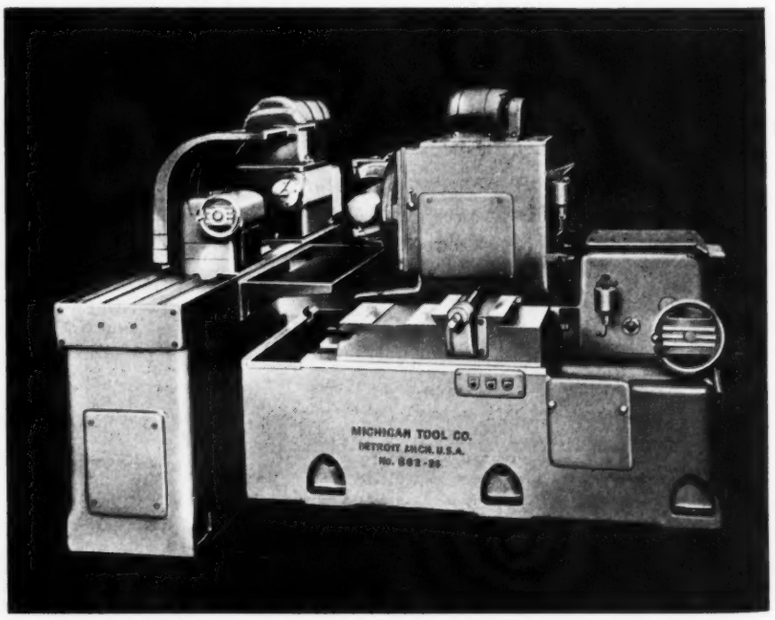
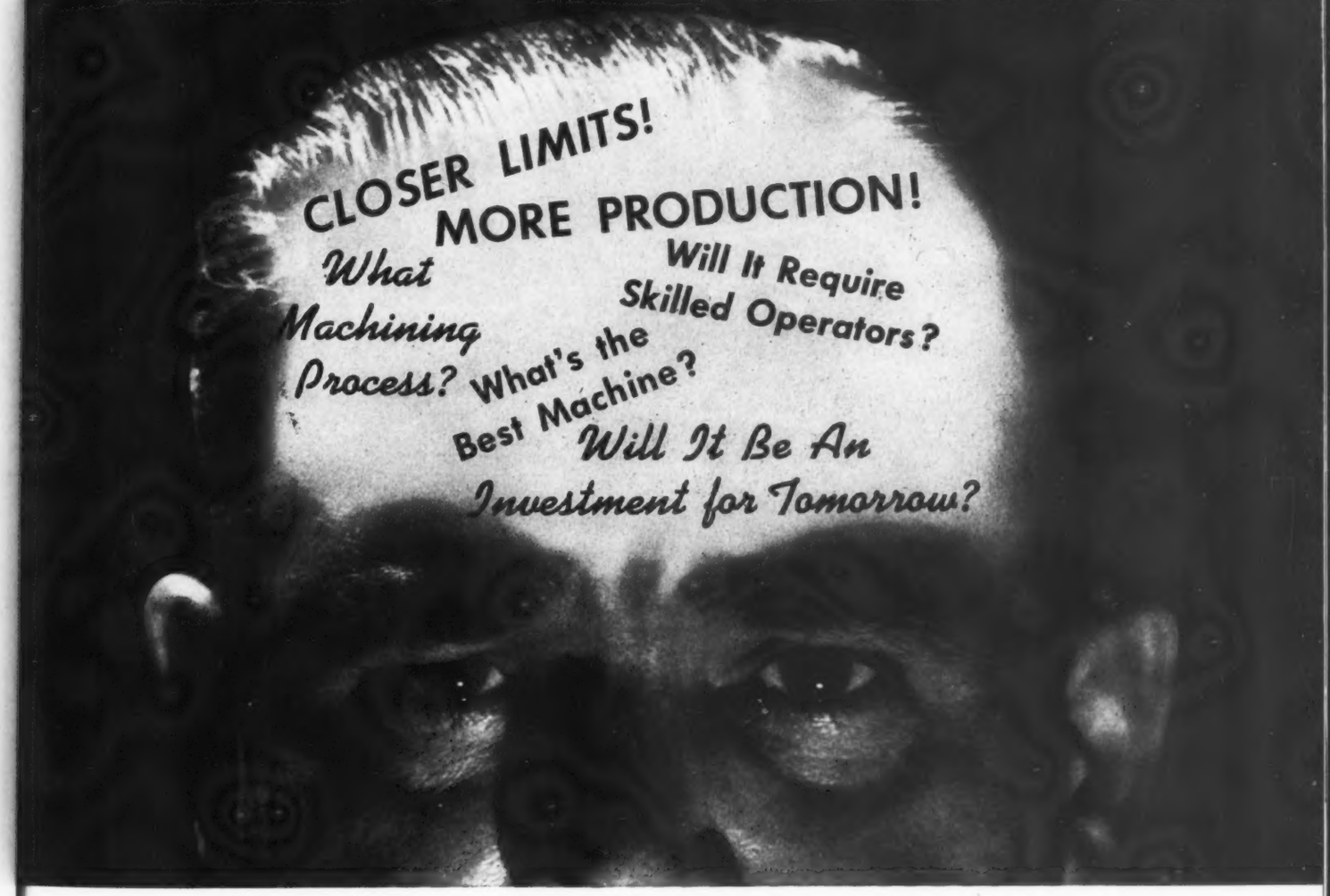


Fig. 2. Michigan Series 862-24 Gear-finishing Machine

To obtain additional information on equipment described on this page, see lower part of page 158.

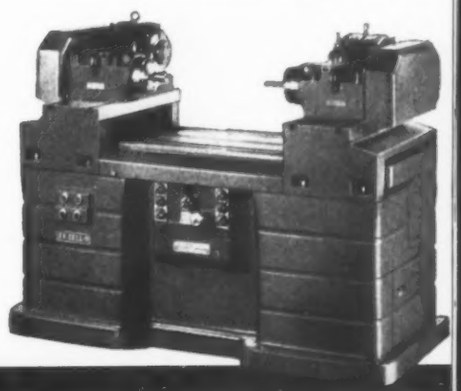
WHAT'S THE ANSWER?



THESE problems . . . more pressing now than ever before . . . find a specific answer wherever production of parts calls for boring, turning, facing, grooving with accuracy and speed. Ex-Cell-O Precision Boring Machines were designed and are made to do exactly this kind of work. With their sturdy, rigid construction, the flexibility in their application, their many automatic features, and simplicity in operation, they produce to "tenth" accuracy . . . and can "take it" round all the hours of the clock . . . *today*, when the greatest pressure that's possible is a national urgency . . . *tomorrow*, when post-war competition will make fast, accurate—and economical—production also a necessity.

EX-CELL-O CORPORATION • DETROIT, MICH.

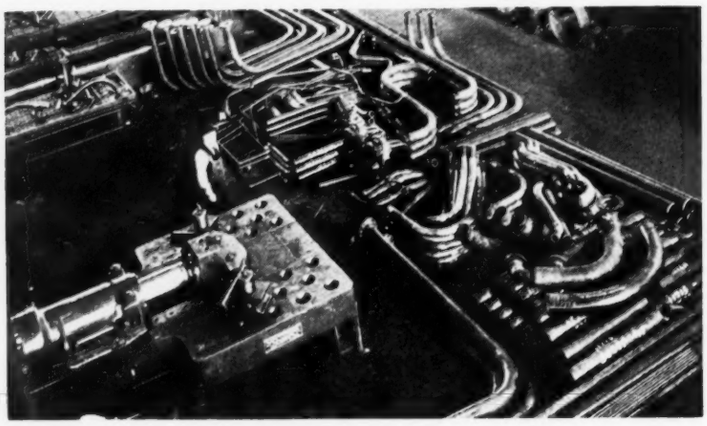
There are nine standard styles of Ex-Cell-O Precision Machines that bore, turn, face, groove with accuracy and speed. They provide an extremely wide range for manufacturers facing production problems today . . . and tomorrow. Below is Ex-Cell-O Style 215-A—Senior Double End Precision Boring Machine.



XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS



Baldwin Southwark Pipe-bending Press

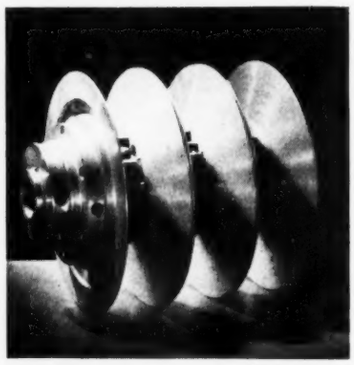
Baldwin Southwark 200-Ton Hydraulic Pipe-Bending Press

The Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa., has brought out a new 200-ton hydraulic pipe-bending press. Actual production experience has indicated that the power of this press is sufficient to enable it to handle most pipe-bending jobs with the pipe cold. This feature not only saves the time required for heating the pipe, but also eliminates distortion of the pipe that occurs during cooling. The bending press is self-contained and oil-operated. It is so designed that it can be kept completely under control by the operator at all times. This sensitive control is particularly valuable when difficult bends are being made. 75

Allis-Chalmers Wide-Range Vari-Pitch Sheave

To meet the demands of the textile and machine tool industries for power transmission in wider ranges of speed variations, a new wide-range Vari-Pitch sheave has been developed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Speed variations of from 66 to 116 per cent are possible with the new wide-range sheave recently added to the regular line of Texrope Vari-Pitch drives made by this company. The new sheave is used with a companion sheave that is grooved for the new wide Texrope V-belts.

Wide-range Vari-Pitch sheaves are now available for distribution in sizes to fit the shafts of all standard N.E.M.A. motors from fractional H.P. sizes up to motors of 30 H.P. Companion sheaves are



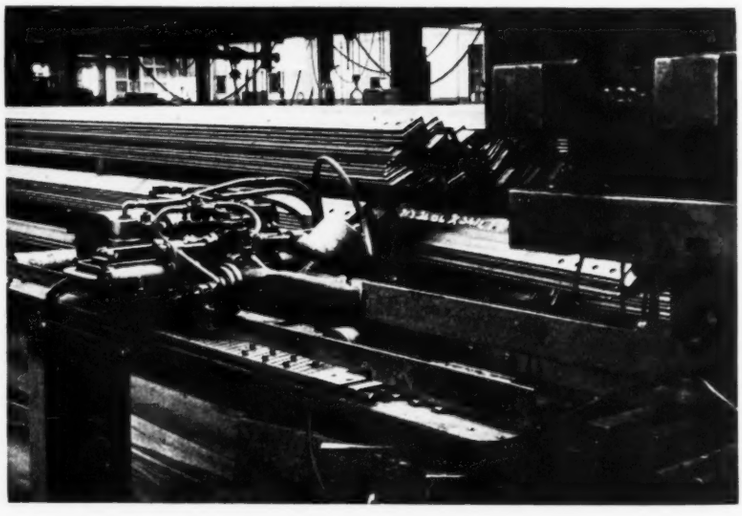
Wide-range Vari-Pitch Sheave

made in sizes to meet the requirements of the wide-range applications. 76

Pollasky Automatic Spacer for Punching Accurately Positioned Holes

An automatic spacer designed for use in steel-fabricating plants, which can be used on any standard punch press, has been brought out by the Pollasky Engineering Co., 828 N. Broadway, Milwaukee, Wis. This spacer, which consists of a carriage that grips the iron structural member to be punched, travels in both the forward and reverse directions over a templet table on which punch settings are predetermined by setting templet pins into fixed pin-locating holes. These locating holes cover the entire templet table and are spaced at 1/16-inch intervals. The operator, sitting in front of the press, can control all of the hole-spacing operations by means of conveniently located levers.

Compressed air provides the motive power, the operator simply throwing the lever, which causes the pneumatic jaw to move into position for gripping the work. Movement of another lever causes the carriage and work to move forward until the carriage comes in contact with the first templet pin. At this point, the hole is punched and the carriage is then released, so that it is free to travel forward to the next templet pin, and so on. On the return trip of the carriage, the same automatic locating and punching operations are performed as on the forward trip. The spacer is capable of operating at approximately 60 feet per minute and



Pollasky Automatic Spacer for Hole-punching Operations

To obtain additional information on equipment described on this page, see lower part of page 158.

Behind the Scenes with DoAll

Metal and alloy parts cut on the DoAll Contour Machine are so smooth and clean that they are all ready for use **without further machining** or finishing. Think of the time this saves!

Then, to add to its versatility, DoAll production engineers have developed valuable **plus** equipment to handle all kinds of heavy work and jobs of irregular shapes — hydraulic work feeds, rip fences, ball-bearing work slides, work holders and guides, supports for long, heavy parts, mitering attachments for cutting tubing and channel stock at any angle, circle cutting fixtures, illuminating magnifying glasses, and others.

AIRPLANE AMBULANCES

The U. S. Air Corps has a fleet of mobile machine shops for repairing damaged planes right on the spot—the shop goes to the plane. Each "ambulance" contains a DoAll Machine as part of its essential equipment.

FOR THAT "BETWEEN MEALS" SLUMP

For the past two years, Continental has been distributing free vitamin tablets regularly to employees and since early this spring, they have also provided free drinks during the middle of each morning and afternoon. Here's a typical month's consumption:

Milk	36,755	bottles
Tomato Juice	4,575	"
Orange Juice	888	"
Total	42,218	"

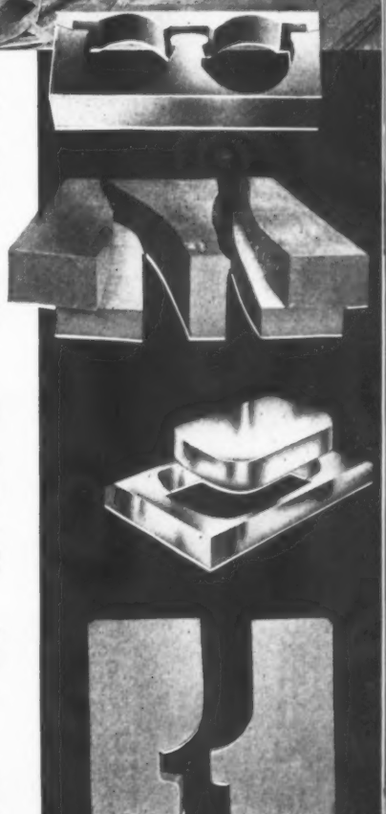
It is estimated that it takes a herd of 26 cows chewing their cud for 30 days to produce the milk. Who says Continental isn't looking out for the farmer?

KINGPIN OF SPEED CONTROLS

The Speedmaster was originally invented to provide infinitely variable speed (6 to 1 ratio) for DoAll Contour Machines. It wasn't long, however, before manufacturers of machinery in other fields discovered that this compact little unit was adaptable to their machines also. Today Speedmasters are controlling machine speeds in plants making hats, textiles, paper boxes, wire and metal products, bakery goods and even for cleaning tons of walnuts. Send for the new 40-page Handbook telling all about the many and varied applications of the Speedmaster.

• Uncle Sam tells us that every ounce of metal saved is vital right now. DoAll saves tons and tons by slicing off any metal or alloy as clean as a whistle. Makes no difference whether it's internal or external cutting, this ultra-modern production machine follows a hairline without any waste. Uncut portions of metal or alloy are usable.

Compare DoAll's economic performance with that of shapers, millers and other machines which reduce tons of metal to chips.

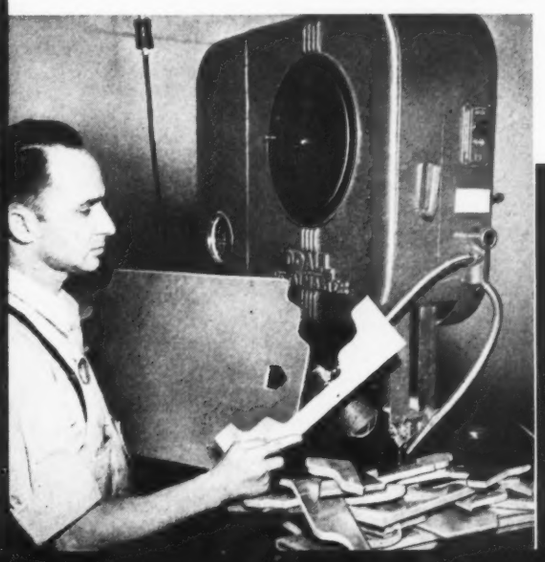


Fastest Method To Remove Metal

In production plants everywhere, DoAll is wrecking former time schedules—doing important sawing and filing jobs in one-half, one-quarter or one-eighth former time.

Let a factory trained man come to your plant with a DoAll and prove its metal and time saving ability to you.

A Size for every Job . . . There is a DoAll to do your particular job faster and better. Throat capacities from 16" to 60". Priced from $1000 to $5000, including motors.



NEW BOOK

"DoAll on Production" shows DoAlls at work in leading plants. An interesting story told in pictures. Send for copy.

punching 10,000 holes per day on long work in which the holes are closely spaced. 77

Improved M & L Tapping Machine

Several improvements have been incorporated recently in the M & L tapping machine made by the Brand Tool & Supply Co., 344 N. Vermont Ave., Los Angeles, Calif. The M & L tapper, formerly made only as a table model, is now available with a 36-inch high base equipped with coolant system. Improvements have also been made in the clutch and pulley design, so that it is now possible to tap holes up to 1/2 inch in diameter in chromium-molybdenum steels, and up to 3/4 inch in diameter in softer metals, such as aluminum, plastics, brass, etc.

The tap used on this machine is guided by precision leads, so that Classes 3 and 4 specifications can be easily met. It also comes equipped with a dial indicator for bottom tapping. Rugged construction combined with sensitivity is one of the advantages claimed for this improved machine. 78

M & L Tapping Machine of Improved Design

Hydraulically Operated "Drilvise" Made by the Studebaker Machine Co.

Studebaker Hydraulic "Drilvise"

A hydraulically operated drill vise which closes and opens automatically and provides a holding pressure of over 10,000 pounds has been brought out by the Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill. This vise, designated the "Drilvise," has been developed for the use of toolmakers and diemakers, machinists, and machine operators. It is designed to hold work on the table of all types of drill presses, planers, shapers, milling machines, surface grinders, lathes, cut-off saws, and other machine tools.

The vise is entirely foot-controlled and hydraulically operated, thus permitting the operator to use both hands for handling the work. The jaws have a width of 6 inches and a throat depth of 3 inches. The maximum width of the jaw opening is 5 inches. The vise has an over-all length of 30 inches, is 8 1/4 inches wide and 5 1/4 inches high, and weighs 74 pounds. The hydraulic foot control is 11 inches high, 10 1/2 inches wide, 14 inches long, and weighs 36 pounds. 79

Thread Milling Cutter that Form-Turns Clearance at Ends of Thread

Buttress-thread milling cutters that relieve the ends of the threaded portion automatically by removing the feather edge at the end of the thread as they mill the threads are now in regular production by the Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich. The thread milling cutters are available in three basic styles designed to relieve one end of the thread only; to relieve both ends; or without plain cutting portions when no thread relief is desired. Fig. 1 shows a style of cutter designed to remove the feather edge at both ends of the thread. A cross-section of the cutter and thread produced with it is shown in Fig. 2.

The cutters can be supplied in any style to suit standard thread milling machines, and in both spiral or straight gash types. These cutters are becoming widely used for both external and internal milling of threads on such parts as cylindrical heads, propeller hubs, etc., the cutters being available in both shell and shank types. The threads, as well as the plain cutting portions of these cutters, are ground from the solid to meet the close tolerances required. 80

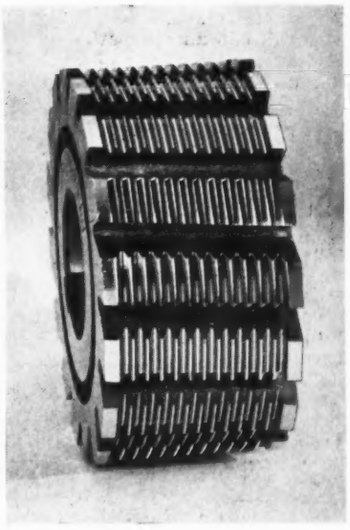


Fig. 1. Thread Milling Cutter Made by Detroit Tap & Tool Co.

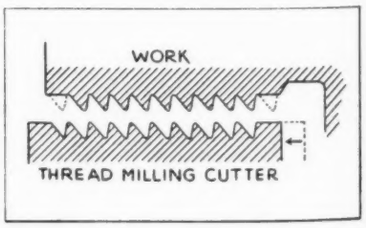


Fig. 2. Cross-section of Cutter and Thread Produced with Clearance at Both Ends

To obtain additional information on equipment described on this page, see lower part of page 158.

ZINC IN WAR

Zinc Coated Steel Cables for Barrage Balloons

ADEQUATE GALVANIZING REQUIRED

The standard for U. S. Army and Navy purchases is *the best available*—and that is as it should be. Not only do our fighting forces deserve the best in performance, but quality insures obtaining full value for every war dollar. Typical of this economy are those war applications of iron and steel which involve corrosion problems. In such cases, *adequate* galvanizing (zinc coating) is required—because scant galvanizing wastes zinc, time and money.

The U. S. Bureau of Standards (Circular 80) states that zinc is "by far the best" protective metallic coating for the rust-proofing of iron and steel. Because zinc is above iron in the electromotive series, corrosion will attack zinc first, thereby protecting the iron from rust. Even though iron or steel is exposed in small areas such as at cut edges, in a protective coating, it is not corroded—if that coating is zinc.

Galvanizing serves the war program in many ways. Illustrated above and below are the all-important *galvanized steel cables on a barrage balloon*, and a few other typical examples of war galvanizing are shown in the background of this page: (1) portable steel landing field, (2) corrugated iron bomb shelter, (3) merchant marine wire rope hoist, (4) wire netting for camouflage. Not illustrated is the all-important zinc-coated pipe on ships.

It is the job of the zinc industry to see that sufficient zinc is available to provide *adequate* galvanized coatings for all-important war applications. This is a major reason why civilian users of metal and pigment may not be able to obtain all of the zinc they would like to have.

THE NEW JERSEY ZINC COMPANY

MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS

10 GALVANIZING

1 HULL PLATES

2 RUBBER

3 PAINT

4 BRASS

5 CERAMICS

6 DIE CASTING

7 PHARMACEUTICALS

8 METAL SPRAYING

9 STAMPING DIES

FOR VICTORY

BUY UNITED STATES WAR SAVINGS BONDS STAMPS

1

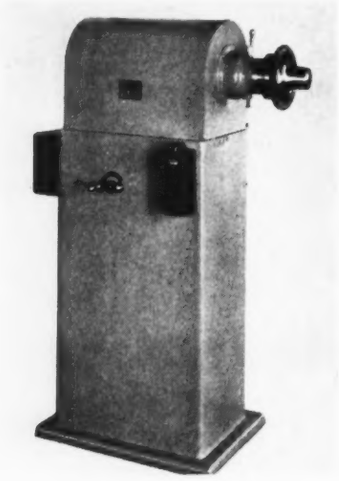
2

3

4

Variable-Speed Lathe with Collet Chuck

The Schauer Machine Co., 2062 Reading Road, Cincinnati, Ohio, has placed on the market a new variable-speed finishing, burring, filing, lapping, and polishing lathe that is especially designed to increase the output of finished screw machine parts in sizes up to 1 3/8 inches in diameter. The Sjogren chuck operates a spring type collet which can be quickly adjusted to suit the size of the work by means of a handwheel mounted on the chuck. The handwheel is deeply grooved to provide for quick, easy opening and closing of the collet.



Schauer Variable-speed Polishing Lathe with Collet Chuck

The new machine is similar to the Schauer standard variable-speed lathes. Motor speeds as low as 20 R.P.M., and ranging up to 4000 R.P.M. are available. The speeds are arranged in the ratio of 6 to 1 for single-speed motors, and 12 to 1 for two-speed motors. Variation in the spindle speeds is obtained through a variable-pitch pulley controlled by a conveniently located ball-crank. Standard size pulleys are used, and connection between the driving and driven parts is obtained by replaceable, standard V-belts. The motor is spring-mounted in the base of the pedestal, and automatically controls the belt tension. The motor and brake control is hand-operated.... 81

Rubberless Feed-wheel for Centerless Grinders

"Saftoid" Rubberless Feed-Wheels

The Safety Grinding Wheel & Machine Co., Springfield, Ohio, has developed a substitute for rubber in the manufacture of the feed-wheels for centerless grinders which were formerly made of hard rubber. The new feed-wheels are known by the trade name "Saftoid." It is stated that these wheels not only cost less, but last longer, than the rubber wheels. 82

Wales Notching Unit

The Wales notching unit shown in Fig. 1 has been brought out by the Strippit Corporation, 1200 Niagara St., Buffalo, N. Y., for notching aircraft bulkhead clearances and similar operations. This notching unit has the same patented features as the Wales hole-punching units previously described in MACHINERY. Nothing is attached to the press ram itself, the self-contained holder maintaining constant punch and die alignment of each unit.

The top portion of each punch fits into notches in a templet, as shown in Fig. 2, for instant resetting of the units. The Wales notching units can be set up in series, as shown, for use on any size and shape of bulkhead. Standard and irregular patterns can be notched in one stroke of the ram. 83

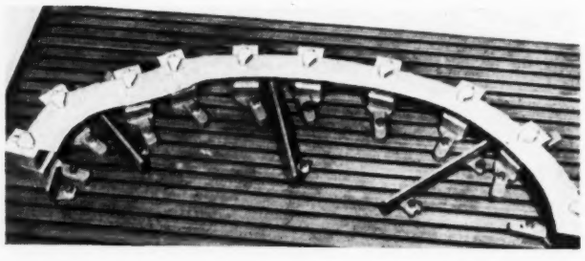


Fig. 2. Setting a Series of Wales Notching Dies by Means of a Templet. The Punches Projecting above the Holders are Located by Notches in the Templet

* * *

Maintenance Hints for Industrial Lighting

Proper maintenance of industrial lighting is as important as the maintenance of manufacturing equipment, because industrial efficiency depends to a large extent on good light. Every plant should have an inspection system and a well organized maintenance program for lighting equipment.

Luminaires should be cleaned frequently. If dirt is allowed to accumulate on reflecting surfaces and lamps, illumination may be reduced from 30 to 50 per cent in a short time. For maximum efficiency, reflectors should be thoroughly cleaned with soap and water. Recently, it was found that the efficiency of an aluminum high-bay reflector was reduced 42 per cent by dirt; and the candlepower was reduced 66 per cent because the direction of the distribution was changed. When lamps fail, they should be replaced at once.

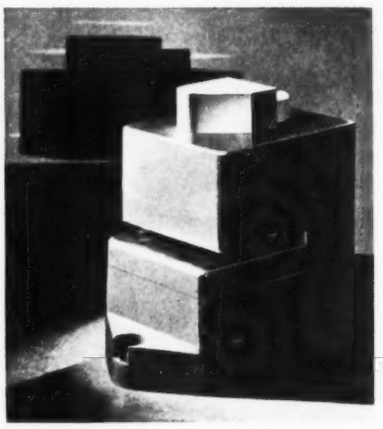
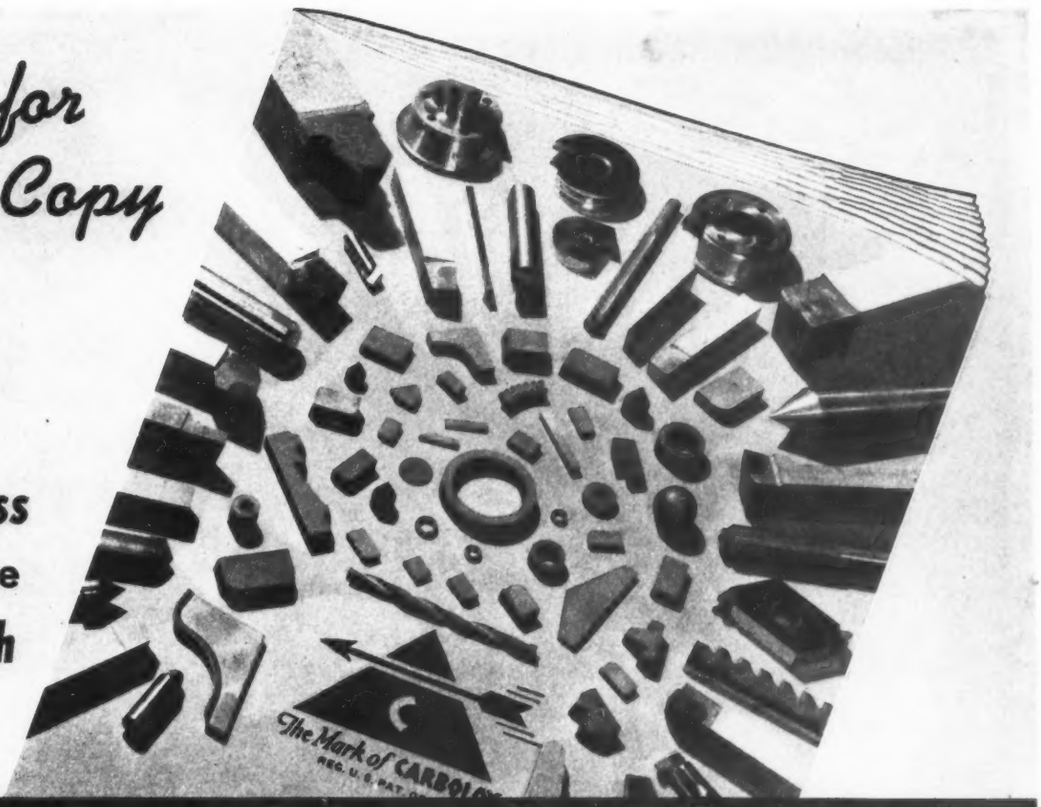


Fig. 1. Wales Notching Unit Made by the Strippit Corporation

To obtain additional information on equipment described on this page, see lower part of page 153.

Send for Your Copy



Off the Press on or before August 15th

New, Complete Carboloy Tool and Blank Catalog

We announce the release—on August 15th—of a special catalog, containing—under one cover—a complete listing of specifications and prices of Carboloy standardized tools and blanks available for war production. Designed to provide a quick, ready reference for those selecting tools for war work, this new catalog lists a wide range of products available in stock for prompt deliveries. As a special supplementary feature, the designs of a number of special types of tools commonly used have been standardized. Specifications and prices of these are included—eliminating delays for quotations, blueprints, etc. Also contains suggestions for saving time and money on your made-to-order tool requirements.

Reserve your free copy today, you'll find it to be a handy, time-saving guide.

Important Listings

Standard Tools (Incl. new sizes to be stocked)	(Stocked)
Standard Blanks (Incl. new sizes and styles to be stocked)	(Stocked)
Standard Boring Tools	(To be stocked)
Diamond-Impreg. Wheel Dressers	(Stocked)
Diamond-Impreg. Grinding Cones	(Stocked)
Masonry Drills	(Stocked)
Carboloy Guide Rings	(Stocked)
Carboloy Brinell Balls	(Stocked)
Lathe and Grinder Center Tips	(Stocked)
Lathe and Grinder Centers	(Partial Stock)
Twist Drill Blanks	(Standard Design)
Shear Type Tools	(Standard Design)
Cut-Off Tools	(Standard Design)
Grooving Tools	(Standard Design)
Plug and Ring Gage Bushings	(Standard Design)
Drill Jig Bushings	(Standard Design)
Roller Turner Tools	(Standard Design)
Staples-Type Exp. Reamers	(Standard Design)
Solid Reamers	(Standard Design)

Etc., etc.

CARBOLOY COMPANY INC., 11147 E. 8 MILE ST., DETROIT, MICH.
Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh
Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY Reg. U.S. Pat. Off.
CEMENTED CARBIDES
TOOLS • DIES • DRESSERS
CORE BITS • MASONRY DRILLS
• WEAR RESISTANT PARTS •
FOR THE MANUFACTURING • MINING • TRANSPORTATION • CONSTRUCTION INDUSTRIES

Making Rubber Belting Last Longer

Rubber belting—whether of the transmission, conveyor, or elevator type—is one of the essential products in keeping the war plants of the nation in operation. The following suggestions for the preservation of rubber belting are made by the United States Rubber Co.:

Observe the same precautions in storing rubber transmission belts as for all other kinds of mechanical rubber goods. Choose a cool, dark, dry location, away from electrical discharges.

Use extreme care that the ends of the belt, when installed, are cut as nearly square as possible. Be sure to use the correct type of belt fasteners. If in doubt, consult a rubber belting sales engineer. Be sure to arrange the drive so that the belt runs fully on the pulleys and not over the edge of them. Run endless belts in the direction indicated on the outer cover, and with the brand name on the outside, away from contact with the pulley.

On quarter-turn drives, the following procedure is sometimes used to equalize wear and stress: When the ends of the belt are fastened together, one end is turned through 180 degrees so that edges and sides are reversed each time the joint passes over a pulley. When belts of this type undergo their final cure, they are put under a carefully predetermined tension to provide a resilient safety factor in the operating belt; the tension should, therefore, be carefully adjusted in order to avoid overstressing the belt.

Make careful periodic examinations to insure that belt tensions are kept at the lowest possible point consistent with efficient driving. Check the alignment of shafts and machines which may change if the building settles. Use no belt dressings on rubber belts, since they contain oils and are injurious to rubber. Exercise continuous care to see that oils and greases do not come in contact with the belt.

If belt surfaces become covered with dust or impregnated with grease, they should be washed carefully with common yellow laundry soap and water. Belts operating in atmospheres of fine dust sometimes take on a hard glazed surface on the pulley side. This can be corrected by holding a cloth, lightly dampened with gasoline, against the belt while it is running.

Wait until machinery stops before removing belts from drives. Often the practice of throwing belts while they are in motion results in sharp twists or bends under tension, which may cause an early breakdown.

* * *

Molybdenum Substituted for Tungsten and Nickel

The accompanying illustrations indicate how molybdenum, 90 per cent of the world's supply of which is mined in the United States, is used as a substitute for scarcer metals. Fig. 1 shows molybdenum high-speed steel at work. These tools, according to the Westinghouse Electric & Mfg. Co., are of equal quality and cost less than tungsten high-speed steel tools. The substitution of molybdenum for tungsten in this instance may become permanent. Fig. 2 shows a case where molybdenum is used instead of nickel as a toughening agent in a motor shaft for a 250-H.P. electric motor for a Diesel-electric locomotive.

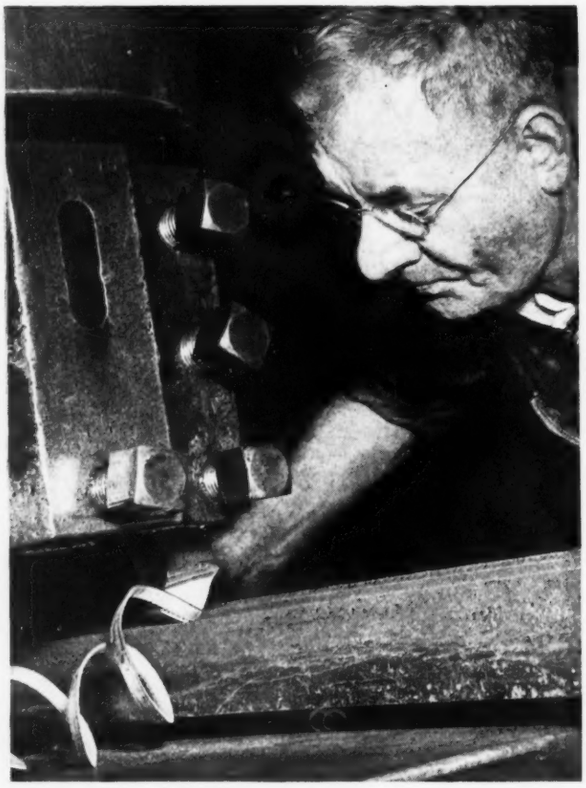
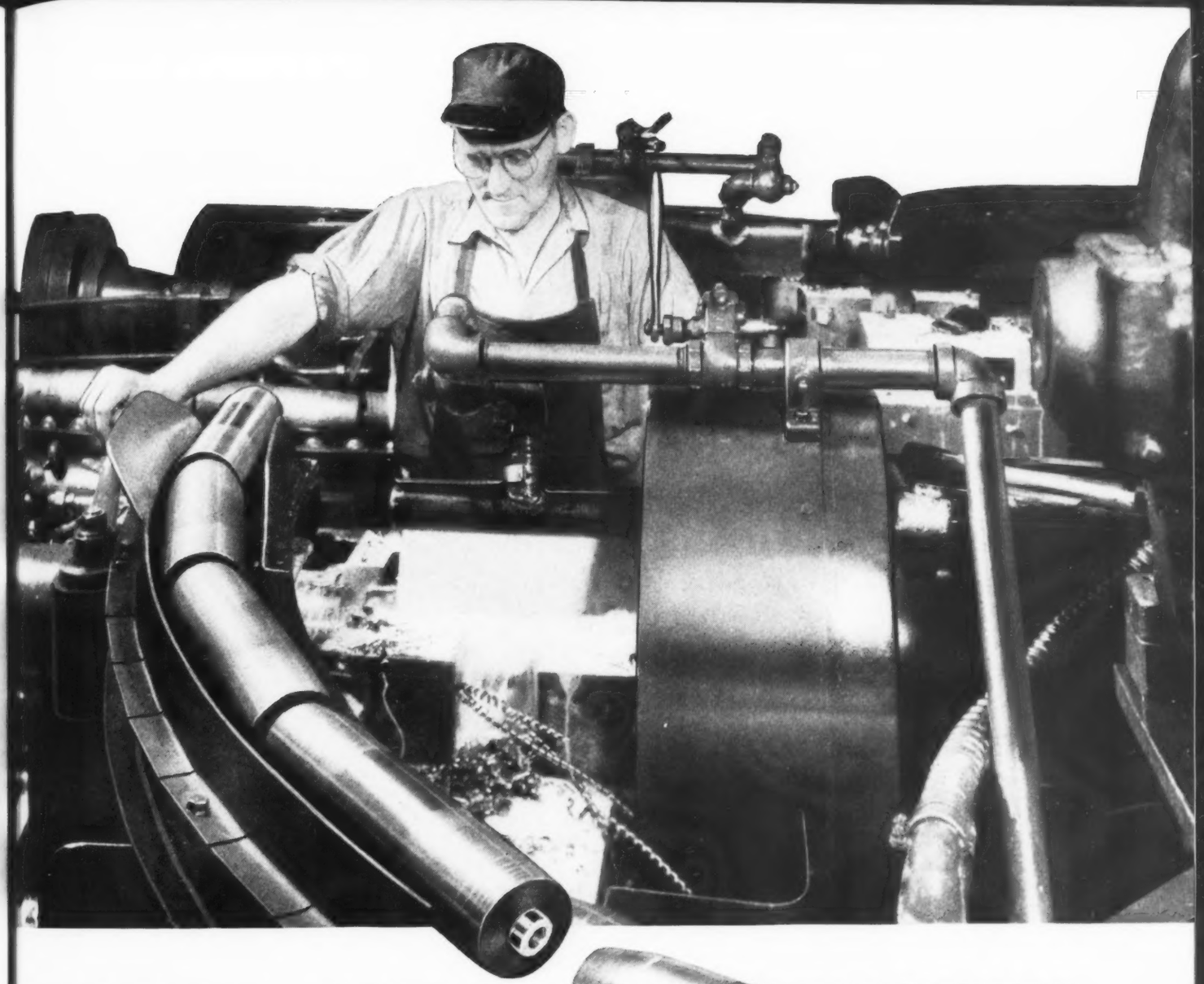


Fig. 1. Molybdenum-steel Tools Take the Place of Tungsten High-speed Steel Tools

Fig. 2. Molybdenum Steel Replaces Nickel Steel in Westinghouse Motor Shafts



SHORT CUTS TO VICTORY!

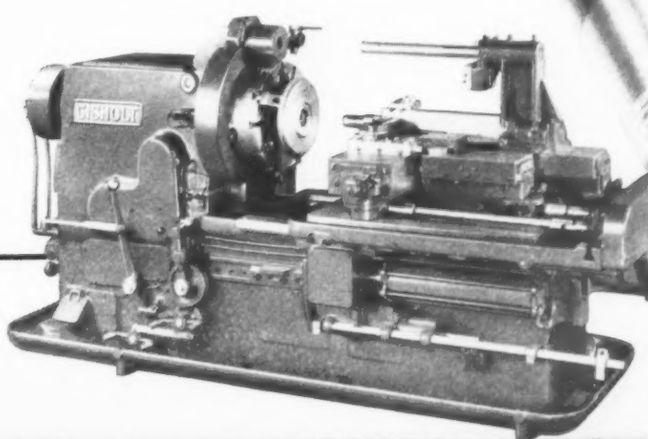
● Faster and faster flows the stream of war production. Faster and faster come the materials from American arsenals and industrial plants.

In the forefront of the production battle today are such time-saving, man-saving machine tools as the Gisholt Simplimatic . . . putting to vital use the peace-time lessons of mass production for millions.

Here, with but little training, one man can out-produce more than two, three, or even four skilled operators on hand-operated, non-automatic machines. Here is high-speed production that short-cuts the road to Victory.

Gisholt Machine Company, 1209 East Washington Avenue, Madison, Wisconsin

THE GISHOLT SIMPLIMATIC *is entirely automatic in operation, designed for multiple cutting, with the ability to maintain accuracy at high-cutting speeds. Extremely simple to operate, it can be tooled to handle a wide variety of cylindrical parts.*



GISHOLT

LOOK AHEAD . . . KEEP AHEAD . . .
WITH
GISHOLT IMPROVEMENTS
IN METAL TURNING

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

R. Hoe & Co. Completes One-Thousandth Pratt & Whitney Profiler

The completion of the one-thousandth P & W profiler, built on contract by R. Hoe & Co., Inc., for Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., was celebrated on July 21 by a ceremony at the Hoe plant in New York City. The ceremony was attended by officers of the Pratt & Whitney organization and officers and workmen of the Hoe company. The speakers on the program were Joseph L. Auer, vice-president, R. Hoe & Co., Inc., who officiated as master of ceremonies; Harry M. Tillinghast, president, R. Hoe & Co., Inc.; Clayton R. Burt, president, Pratt & Whitney; Colonel Edward A. Deeds, chairman, National Cash Register Co. and Pratt & Whitney; George C. Brainard, chief, Tool Section, War Production Board; and General Walter P. Boatwright, district chief, New York Ordnance District, U. S. Army.

R. Hoe & Co., Inc., whose regular line of manufacture is printing machinery, has demonstrated in characteristic American style its ability and willingness to rapidly convert its manufacturing facilities to an entirely different type of product to meet the war emergency. After Pratt & Whitney had completed arrangements with the Hoe company to make the P & W profiler, the first fifty machines were shipped in July, 1941, just seven months after the order was placed. The one-thousandth profiler —just delivered—will be followed by a substantial number of additional machines.

A Century Milestone in Photography

The one-hundredth anniversary of the opening of the first photographic supply house in the United States at 308 Broadway, New York City, was celebrated at the Waldorf-Astoria Hotel in New York, on July 23, to pay tribute to Edward Anthony, the founder of the business, which later became Anthony & Scovill and since has become Agfa Ansco of Binghamton, N. Y.

In connection with the celebration, a collection of historical photographs and photographic equipment was exhibited. Much of this exhibit had never before been placed on public view. Some of it, loaned by the Philadelphia Museum of Photography, contained such original specimens as the first photographs ever made of Niagara Falls, the first view ever taken from the air, and the first photograph of lightning. Other interesting exhibits came from the private collection of A. E. Marshall, executive head of Agfa Ansco, which is considered without an equal among historic collections.

At the dinner, William Henry Jackson, 99-year-old dean of photographers, was scheduled to be a guest of honor. Unfortunately, Mr. Jackson passed away less than four weeks before the event, but his chair at the speakers' table remained there, unoccupied.

A genuine "magic lantern" show was given, probably the first of its kind seen in New York in the last forty years. The actual slides and lantern of seventy-five years ago were used. It was surprising to note how even then the art of creating many such supposedly modern effects as fade-outs, snowstorms, motion in pictures, etc., was understood. Two announcements concerning new processes perfected by research were made, one relating to a color photography process which permits of practically as easy development of the pictures as is now the case with black and white films, and one having to do with a new method of reproducing sound, especially music, that appears to be a great advance.

* * *

Welding Inspection Chart

An arc-welding inspection chart that will provide welding inspectors and welders with a simple helpful aid for use in inspecting welds has been published by the Lincoln Electric Co., Cleveland, Ohio. The chart presents graphically the different types of welds obtained when the work is done correctly—with normal current, voltage, and speed—as compared with those obtained when these factors are not normal.

Motion Pictures on Fabricating Aluminum

Three different motion picture films have been produced by the Aluminum Co. of America on the subjects of welding, riveting, and machining aluminum. These films are intended solely for instruction purposes. The views are close-ups, showing in great detail every step taken by the worker in welding, riveting, or machining, and are accompanied by the required explanations.

The films demonstrate effectively the value of motion pictures for instruction purposes. In handling the subject, brief "shots" that leave much to the imagination have been avoided; instead, great care has been taken to show operations in minute detail and without any effort to hurry the procedure. One great advantage of motion pictures for instruction purposes is that parts of the picture can be shown over and over again, if necessary, to thoroughly cover a point.

The films are available for use in the industry for instruction purposes by communicating with the Aluminum Co. of America, Pittsburgh, Pa.

* * *

Ideas for Victory

An unusual idea in wartime advertising is presented in a series of advertisements by the Warner & Swasey Co., Cleveland, Ohio. This series is called "Ideas for Victory," each advertisement featuring some shop method, tool, or device that has aided in increasing production. In addition, the individual operator who has suggested the idea and who is making use of it in the shop where he is employed is featured in the advertisement, the purpose being to recognize the initiative and ingenuity of these men, who are doing the best they can with whatever equipment they have at hand.

* * *

The American Gear Manufacturers Association reports that industrial gear sales in June were 24.7 per cent above June, 1941. The sales for the six months ending June, 1942, were 35.6 per cent above the corresponding period in 1941.

"That's why we call 'em 'Victory' lathes!"

Dear Frank:

Madison, Wisconsin

Remember how busy we thought we were last summer, before you left? Honestly, that was just a breeze compared with the way things are going now!

Guess we told you about those big turret lathes we're going to build in such large quantities. With a few modifications -- with a new production set-up -- and with the green light from Uncle Sam, we're going to turn them out 150% faster than we've ever built these sizes! That'll put 'em where they're needed in a hurry! That's why we call 'em "Victory" lathes!

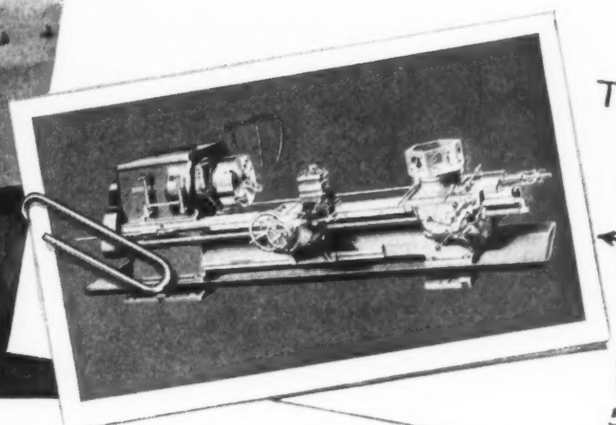
So you see, we're rolling, too, Frank! And we're going to keep it up just as fast and as long as we have to until the Axis hollers "'Nuff!"

That's the way we feel about it. So do the fellows who will operate these lathes. It's our fight as well as yours. So, if it's a war of machines they want, let's give it to them! They asked for it!

Keep 'em rolling, and we'll do the same!

Best regards,

The fellows at Gisholt



Here's how the new "Victory" models look. They're modified versions of the standard Gisholt Saddle Type Turret Lathes with 21" and 24" chucks 5¼" and 9¼" spindle bores

GISHOLT

Here's news as welcome on the production front as it is on the fighting front. Learn what Gisholt is doing to help solve a pressing problem for America's vital war industries today.

NEWS OF THE INDUSTRY

California

NORRIS STAMPING & MFG. CO., Los Angeles, Calif., has been presented with a "star" to be added to the Navy "E" flag which was awarded the company last August for excellence of production. The "star" is awarded as an indication of continued excellence in production, and is equivalent to another separate award in recognition of the work of a manufacturing organization.

JAMES M. HOGHLAND has been appointed sales engineer in the Pacific Coast area for the American Screw Co., Providence, R. I. Mr. Hoghland will work in cooperation with K. T. JACKSON, who has formerly been covering the entire territory. For the present, Mr. Hoghland's headquarters will be at 1724 N. Vista St., Hollywood, Calif.

VICTOR EQUIPMENT CO., is now handling the complete line of stainless-steel and alloy electrodes manufactured by Arcos Corporation, Philadelphia, Pa. The Victor company has sales offices in Los Angeles, San Francisco, Fresno, Bakersfield, and San Diego, Calif., as well as in Phoenix, Ariz.

PACIFIC TOOL & SUPPLY CO., 344 N. Vermont Ave., Los Angeles, Calif., announces that the name of the company has been changed to the BRAND TOOL & SUPPLY CO.

Connecticut

GEORGE H. KENDALL, for the last six years senior commercial service engineer for the Norma-Hoffmann Bearings Corporation, Stamford, Conn., recently resigned to devote full time to his professional consulting engineering practice on war problems of manufacturing investigations, fabrication processes, and special machinery development and invention. He was formerly chief engineer for the Bearium Metals Corporation, Rochester, N. Y.

ROBINSON D. BULLARD, reclamation engineer for the Bullard Co., Bridgeport, Conn., maker of Mult-Au-Matics and vertical turret lathes, has been appointed technical consultant to the Industrial Salvage Section of the Bureau of Industrial Conservation of the War Production Board. He will assist in preparing a book on industrial reclamation.

HENRY FISHBECK has been transferred from the inspection department of Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Conn., to the manufacturing department, where he will be responsible for materials processing.

CHARLES A. MABEY has been appointed director of the research activities of the Bristol Co., Waterbury, Conn., manufacturer of industrial process instruments and automatic control apparatus. Mr. Mabey has served as a physicist for several years in this organization.

Illinois

TWIN DISC CLUTCH CO. has installed new machines and manufacturing facilities at its plant in Rockford, Ill. This expansion of the business is due to the creation of a separate division of the company to handle the development, production, and sale of hydraulic drives and torque converters, formerly a department of the organization at Racine, Wis. R. M. SCHAEFER has been named vice-president in charge of the Hydraulic Division, all of the activities of which will now be concentrated in Rockford.

ONSRUD MACHINE WORKS, INC., Chicago, Ill., announce the conclusion of an expansion program begun several months ago. A new wing has been added to the plant, and the roof has been raised to permit the addition of another floor. The total increase of floor space will result in a production capacity almost twice as great as before. The work of raising the roof was done without interrupting the operation of the plant.

E. A. GEBHARDT has been elected president of Commercial Advertising Agency, Inc., 600 S. Michigan Ave., Chicago, Ill. Mr. Gebhardt has been active in the affairs of the Chicago Industrial Advertisers Association as chairman of various committees, director, and vice-president in charge of programs, at the same time serving on N.I.A.A. committees.

ROBERT M. KALB has been appointed chief engineer of the Kellogg Switchboard & Supply Co., Chicago, Ill., and B. A. WALLACE has been advanced to assistant chief engineer.

M. E. CLARK, sales manager of the Randall Graphite Products Corporation, Chicago, Ill., has been commissioned a Major in the Ordnance Corps. His successor has not yet been appointed.

Indiana

W. R. BEATTY, founder of the Beatty Machine & Mfg. Co., Hammond, Ind., manufacturer of heavy metal-working equipment for tank shops, shipyards, car shops, and other heavy metal-fabricating plants, has been elected chairman of the board. L. C. BEATTY has been elected president; and P. H. BEATTY vice-president.

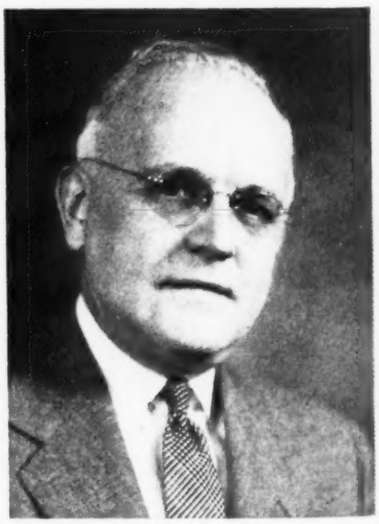
DAVID LOGAN and FRANK W. PEDROTTY have been appointed sales representatives for the American Foundry Equipment Co., Mishawaka, Ind. Mr. Logan will be located at 242 Broad St. Apartments, Newark, N. J., and Mr. Pedrotty at 911 Wynnewood Road, Philadelphia, Pa.

W. K. MILLHOLLAND MACHINERY CO., 1048 Fairfield Ave., Indianapolis, Ind., announces that the company now has the exclusive rights to manufacture Millholland automatic drilling, boring, milling, and tapping units and special machinery under Millholland patents.

ROBERT H. PYLE has been appointed district representative in southern Indiana for the McKenna Metals Co., Latrobe, Pa. His headquarters are at 3801 College Ave., Indianapolis.

Massachusetts

UNIVERSAL BORING MACHINE CO., Hudson, Mass., announces the election of the following officers: President,



Ernest S. Jefferies, New President of the Universal Boring Machine Co.

STURDY from the Base up ...

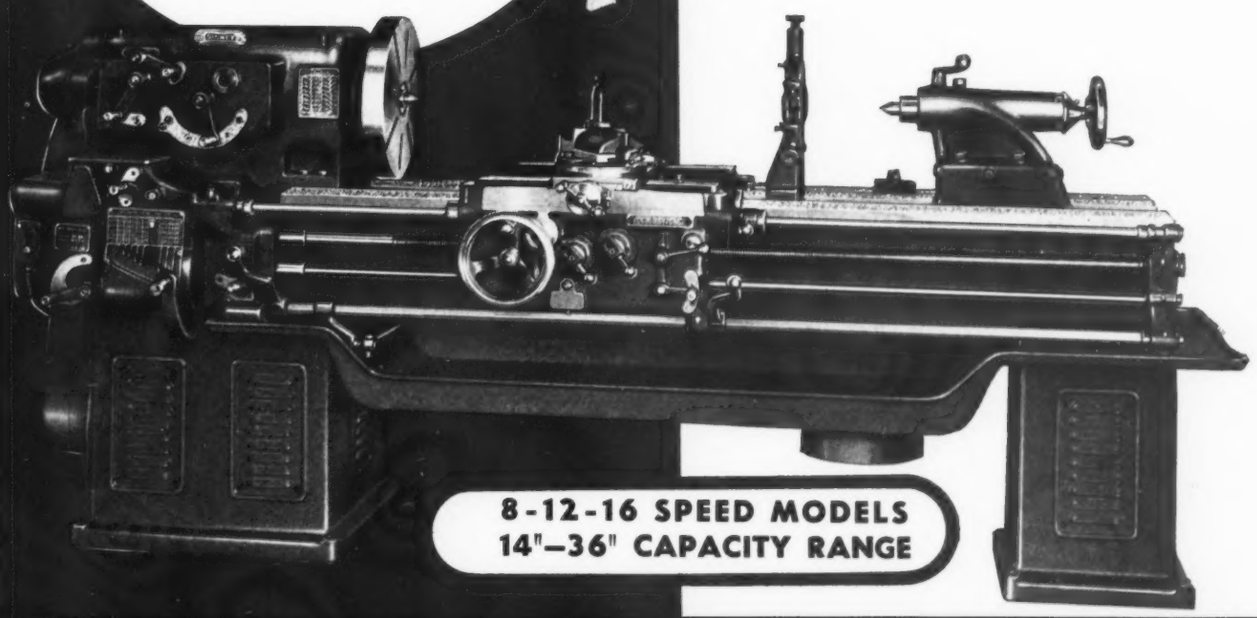
Sidney Lathes

Sound engineering from the base up results in a superb machine tool with several outstanding features which definitely improve production and assure dependable accuracy over a long span of profitable years.

RIGID BED CONSTRUCTION

One of these features is the Bed of the Sidney Lathe. Four longitudinal walls (as illustrated) with cross girts at 12" intervals resist deflection and twisting strains. This type of bed supporting the various units of the lathe is essential to eliminate vibration and assure continued accuracy.

Complete details described and illustrated in available bulletin.



8-12-16 SPEED MODELS
14"–36" CAPACITY RANGE

The SIDNEY MACHINE TOOL Company
SIDNEY U.S.A. OHIO

ERNEST S. JEFFERIES; vice-president and chairman of the board, CHARLES A. CLARKE; vice-president, JOSEPH WIGGIN; and treasurer, ALSON H. GOODSELL.

BLANCHARD MACHINE CO., 64 State St., Cambridge, Mass., manufacturer of surface grinding machines, has appointed the C. H. BRIGGS MACHINE TOOL CO., Onondaga Hotel Building, Syracuse, N. Y., representative of the company in the Syracuse territory, which embraces the central area of the state of New York and some counties in the northeastern part of Pennsylvania. In the Buffalo and Rochester territory, embracing the western portion of New York, the GEORGE KELLER MACHINERY CO., 1807 Elmwood Ave., Buffalo, N. Y., has been appointed representative. This change in representation has been occasioned by the retirement of Henry Prentiss & Co. C. H. BRIGGS, president of the C. H. Briggs Machine Tool Co., and E. F. MORGAN and J. A. CARTER, now associated with the George Keller Machinery Co., were formerly with Henry Prentiss & Co. in the same territories.

SQUARE D CO. announces the opening of a branch office at 146 Chestnut St., Springfield, Mass., with C. T. NASH in charge. Mr. Nash was in the New York office of the company for twelve years, serving as machine tool control specialist. The new branch will serve the Hartford area; Springfield, Vt.; Worcester, Mass.; and Providence, R. I.

F. W. MCINTYRE has returned to his duties as vice-president and general manager of the Reed-Prentice Corporation, Worcester, Mass., after spending fifteen months with the War Production Board, Tools Section, at Washington, D. C.

Michigan

COLONIAL BROACH CO., Detroit, Mich., will shortly occupy a new plant designed to more than double its broach manufacturing capacity. The new plant is a further addition to the increased facilities for the manufacture of broaching machines provided by the erection of a No. 2 plant in the same locality about a year ago. The latter plant capacity is also being expanded. After the company moves into its new quarters, the No. 1 plant will be entirely occupied by COLONIAL BUSHINGS, INC., and NEW METHOD STEEL STAMPS, INC., so that these concerns also will have added manufacturing facilities.

RACY D. BENNETT has joined the engineering staff of the Vinco Corporation, 9111 Schaefer Highway, Detroit, Mich., builder of gages and machine tools, in the capacity of development engineer. Mr. Bennett has been engaged in engineering and consultant service for the last two years, and previous to that was connected for five years with the Ex-Cell-O Corporation of Detroit. L. A. WARD has also joined the engineering staff of the corporation. Mr. Ward has had wide experience in the application of hydraulics to machine tool design. For two years he was chief engineer of the Fox Machine Co., for whom he developed a line of hydraulically operated multiple-spindle drills.

HARRY L. WISE has been made president and general manager of Hydraulic Machinery, Inc., 10421 Grand River Ave., Detroit, Mich. Mr. Wise

Harry L. Wise, President and General Manager of Hydraulic Machinery, Inc.

has been sales engineer with Vickers, Inc., manufacturers of hydraulic equipment, in the Detroit territory for the last seven years, and has been engaged in tool engineering and machine design in this area since 1918.

WALTER F. CAHILL was recently appointed agent for the Lincoln Park Tool & Gage Co., Lincoln Park, Mich., in the state of Michigan, exclusive of Wayne County, and Toledo, Ohio. For the last nine years he has been associated with the National Automatic Tool Co., Richmond, Ind., as sales engineer in the Detroit office.

New Jersey

DAN C. HUNGERFORD has resigned as vice-president and director of the Elastic Stop Nut Corporation, Union, N. J. He joined the corporation in

Dan C. Hungerford, Who has Resigned as Vice-president and Director of the Elastic Stop Nut Corporation

1936 as field engineer, and eighteen months later was made chief engineer. In January, 1940, he was elected to the board of directors and, in July of the same year, was made vice-president in charge of engineering. He was placed in charge of the corporation's sales and advertising activities in 1941.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has been awarded the Navy "E" pennant for excellence of production. Rear Admiral Henry A. Wiley made the presentation to Hobart C. Ramsey, vice-president in charge of operations, who accepted it on behalf of the Worthington organization.

New York

WILLIAM B. GRIESE, plant manager of the Lycoming Division of the Aviation Corporation, New York City, has been made plant manager of the company's new Liquid-Cooled Engine Division. He will be succeeded at the Lycoming Division by M. I. Bradley, works manager. IRA J. SNADER, division manager of the Republic Aircraft Products Division of the Aviation Corporation, has been made vice-president of manufacturing of the corporation, and will be succeeded in his former position by STERLING B. WITHINGTON, formerly general manager of the Brunswick-Balke-Collender Co., Muskegon, Mich.

BENJAMIN SACK has been elected president of the Aircraft Screw Products Co., Inc., Long Island City, N. Y., manufacturer and licensor of the Aero-Thread screw thread system, to

TAKE *Guesswork* OUT OF PRODUCTION

Put SUNOCO EMULSIFYING CUTTING OIL to work . . . for long tool life . . . accuracy . . . fine finish

Victory production — the steady stream of machined parts for finished war products — isn't achieved by guessing. The selection of the proper tool set-up, correct speeds and feeds, and the right application of the right cutting lubricant are all important for machine tool operation at rated capacity-plus.

That's why so many leading plants throughout the nation rely on Sunoco Emulsifying Cutting Oil and the recommendations of Sun Oil Engineers to meet their cutting oil needs.

Sunoco's exceptional heat-absorbing and lubricating qualities permit longer tool life, "nth" degree accuracy, and fine surface finish.

Sun Oil Engineers — those capable Doctors of Industry — offer you technical service based on scientific training and practical experience that will help you solve your machining problems. Their recommendations are not guesswork. They stand ready . . . willing . . . and able to help you in your plant. For helpful case histories on how they aided other leaders in the metal working industry, write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY • Philadelphia, Pa.

Sun Oil Company Ltd., Toronto

LET'S GO! U.S.A. KEEP 'EM FLYING!

PERFORMANCE DATA

OPERATION—Tapping ring nuts.

MACHINE—3-L Gisholt Turret Lathe.

MATERIAL — Forged steel.

CUTTING LUBRICANT —1 part Sunoco to 15 parts water.

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

©Underwood & Underwood

Benjamin Sack, Newly Elected President of Aircraft Screw Products Co.

fill a vacancy created in August, 1941. Mr. Sack was formerly executive vice-president. He was associated with Harold Caminez, the inventor of the Aero-Thread, in the early development stages, and took over the general management of the company when Mr. Caminez became consulting engineer.

CLUTSOM MACHINES INCORPORATED, 205 E. 42nd St., New York City, has been appointed exclusive agent in the New York territory for the DEARBORN GAGE CO., Dearborn, Mich., manufacturer of chromium-plated gage-blocks.

HOWARD M. ROBINS has been appointed publicity manager of J. H. Williams & Co., Buffalo, N. Y., manufacturers of drop-forgings and drop-forged tools. He has been a member of the advertising staff for four years, and succeeds the late Hugh Aikman as head of the advertising department.

Howard M. Robins, Recently Appointed Publicity Manager of J. H. Williams & Co.

H. M. HARPER CO., dealer in brass, bronze, stainless steel, etc., has moved its New York City office to the Dodge Building, 45 West Broadway. It is announced that the staff of the office has been enlarged, the manager being EARLE A. CHANNER, previously in the sales department at the main office in Chicago. EDWIN D. HIGGINS and ELIOTT S. JACKSON have joined the New York office.

WILLIAM M. BLACK was made a vice-president of the American Brake Shoe & Foundry Co., New York City, at a recent meeting of the board of directors. Mr. Black has been president of the American Manganese Steel Division of the company since 1940, and will continue in that capacity.

FRANK J. HILL has been elected vice-president of Greene, Tweed & Co. of New York City, manufacturers of Palmetto and other mechanical packings and special tools. Mr. Hill has been sales manager of the company for many years.

J. M. HOPKINS, who has been associated for some time with Morris & Van Wormer, management and production engineers, 25 Broad St., New York City, has been made a partner of the firm. Mr. Hopkins was formerly president of the Augorean Mfg. Co.

Ohio

LINCOLN ELECTRIC CO., Cleveland, Ohio, manufacturer of arc-welding machines and electrodes, recently awarded service pins to 206 employes with tenure of service ranging from ten to thirty-five years. Two recipients of citations whose service records extend over a period of thirty-five years were James F. Lincoln, president and general manager of the company, and J. C. Lincoln, chairman of the board and treasurer. Among the employes with the longest records was Joe Satava, Jr., inspector in the punch press department, who has worked for the company during the last thirty years. Of the others receiving service pins, eight had been connected with the company for twenty-five years, twenty-six for twenty years, sixty-six for fifteen years, and 103 for ten years. The twenty-five year group included A. F. Davis, vice-president and secretary, and C. M. Taylor, vice-president and sales manager. During this occasion, the employes presented the president of the company with a watch and chain, and a scroll reaffirming their confidence in his leadership.

CINCINNATI BICKFORD TOOL CO., Oakley, Cincinnati, Ohio, has appointed the following new agents to handle the sale of the company's Super Service radial drills, upright drills, and jig boring machines in New England and New York. These representatives replace Henry Prentiss & Co., who are retiring from business as machine tool dealers. WIGGLESWORTH MACHINERY CO., 199 Bent St., Cambridge, Mass., will cover the states of Connecticut, Massachusetts, Rhode Island, New Hampshire, Vermont, and Maine; RUDEL MACHINERY CO., 200 Fifth Ave., New York City, eastern New York State and northern New Jersey; C. H. BRIGGS MACHINE TOOL CO., INC., Onondaga Hotel Bldg., Syracuse, N. Y., central New York and northeastern Pennsylvania; GEORGE KELLER MACHINERY CO., 1807 Elmwood Ave., Buffalo, N. Y., western New York, including Buffalo and Rochester.

WORTHING H. STONE has been appointed assistant advertising manager of the Timken Roller Bearing Co., Canton, Ohio, in charge of advertising for the railroad, farm implement, automotive, and rock bit divisions. He has been previously engaged in sales promotion work for the company. S. L. HUFFMAN, a member of the advertising staff for several years, has been advanced to the position of manager of the News Bureau; he will continue to handle the advertising of the Steel and Tube Division. PETER C. POSS will continue his present activities as assistant advertising manager and, in addition, will take over the publishing of technical information for the engineering fraternity, an activity which the company plans to expand considerably in co-operation with the war effort.

CINCINNATI PLANER CO., Cincinnati, Ohio, manufacturer of Hypro planers, vertical boring mills, and planer type millers, is serving its present and prospective customers in New England, New York State, northern New Jersey, and a part of Pennsylvania directly from its Cincinnati office. This territory was formerly handled by Henry Prentiss & Co., Inc., whose retirement from active business was recently announced. The C. H. Briggs Machine Tool Co. of Syracuse, N. Y., will represent the company in the Syracuse territory.

SEWARD A. COVERT has been appointed assistant to the president of the Ohio Crankshaft Co., Cleveland, Ohio, in charge of public relations and industrial publicity. Mr. Covert has served the Ohio Crankshaft Co. as public relations counselor for more than a year while associated with Graves Taylor & Associates, of Cleve-

REEVES *Motodrive*

is Motor + Variable Speed + Gear Reducer

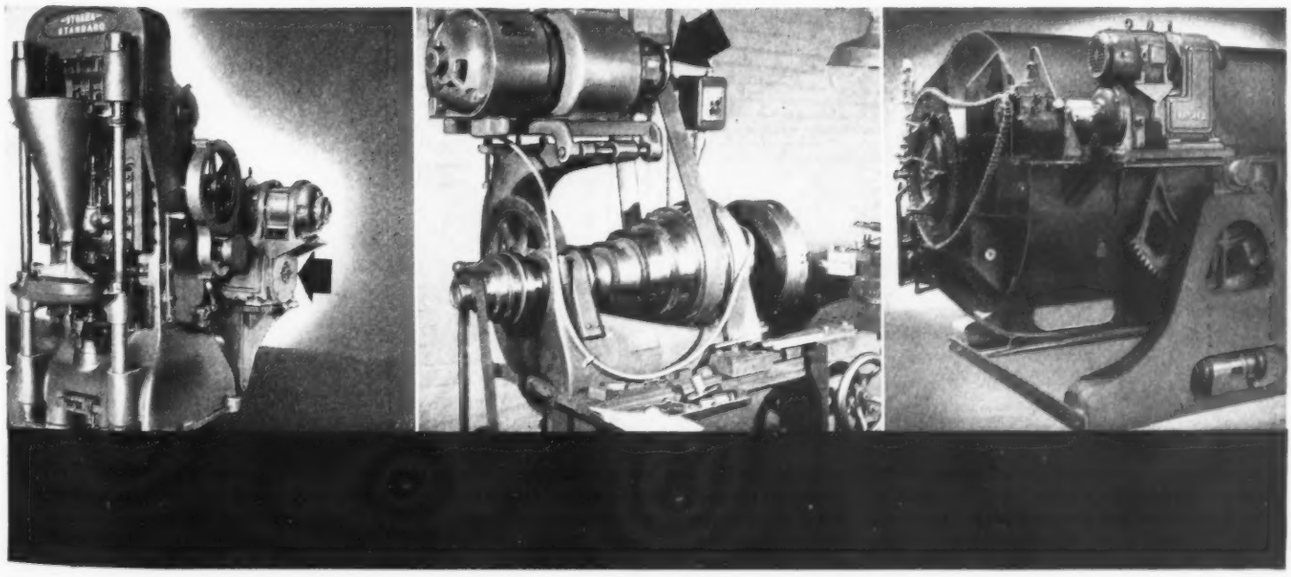
—*All in* 1 *Compact Unit!*

Install This Space-Saving Drive on Your Production Machines and Give Them "Fighting Speeds" for Faster Output

● On production machines where space is limited, or where direct connection to machine is necessary or desirable, the REEVES Motodrive solves the problem of providing infinitely variable and accurate speed regulation. This compact assembly of constant speed motor, variable speed mechanism and gear reducer (if needed) utilizes proved REEVES principle of a V-belt driving between two pairs of cone-faced discs adjustable to form an infinite number of driving and driven diameters. Any desired speed between predetermined limits is available at turn of REEVES Speed Control handwheel—*without stopping* driven machine.

The Motodrive is not restricted to any one make of motor. The unit is available, with or without speed reducer, in two designs, vertical and horizontal. Sizes from 1/4 to 10 h.p. and speed ratios from 2:1 through 6:1. Many different assemblies as to motor, output shaft, handwheel and speed reducer make the Motodrive adaptable for application to any driven machine. Gives any machine "fighting speeds" for more output. For further information on the Motodrive and two other basic REEVES units—Transmission and Vari-Speed Motor Pulley—send for 124-page Catalog Manual M-419.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA



land. He will continue to promote the company's extensive War Production Drive program in conjunction with other duties.

PHILIP F. SMITH, secretary of the Osborn Mfg. Co. of Cleveland, Ohio, maker of foundry molding machines and industrial brushes, has accepted an appointment as a senior priority specialist in the Special Industrial Machinery Branch of the War Production Board for the duration of the war. No successor will be appointed to fill his post, as his duties will be divided among other officials.

ELWELL-PARKER ELECTRIC CO., 4205 St. Clair Ave., Cleveland, Ohio, announces the election of S. K. TOWSON as president in place of the late Morris S. Towson. He will also serve as general manager. W. A. MEDDICK has been elected vice-president.

REYNOLDS MACHINERY CO., 2153 Prospect Ave., Cleveland, Ohio, announces the opening of a Columbus, Ohio, office. Other branch offices of the company are located at Akron and Toledo. W. V. TERRY will be in charge of the Columbus office.

Pennsylvania and Delaware

R. NEVIN WATT has been appointed general sales manager of the Baldwin Locomotive Works, Philadelphia, Pa., and will have general supervision over all sales of the locomotive and ordnance division and the Standard Steel Works division. STEWART MCNAUGHTON will continue as sales manager for steam locomotives; CLYDE G. PINNEY as foreign sales manager; and GUNTHER H. FROEBEL as sales manager of ordnance and general products. WALKER H. EVANS has been appointed sales manager of the Standard Steel Works division of the company to replace Mr. Watt. JOSEPH G. BROZ, formerly sales manager for the Baldwin De La Vergne Sales Corporation, has been appointed sales manager of the Diesel division.

R. Nevin Watt, New General Sales Manager of the Baldwin Locomotive Works

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., recently awarded the Westinghouse Order of Merit to six employes for distinguished service. This award is made in recognition of the employes' outstanding contribution to electrical and mechanical arts and to their company's progress. Those receiving the award were L. R. BOTSAI, manager of the gearing department of the Westinghouse motor division; P. S. EMMETT, foreman of the heat-treating department; A. ROMAN, a toolmaker; C. W. DRAKE, manager of the general mills section of the engineering division; W. P. KELLY, negotiation supervisor in the motor division; and J. R. PICKELS, a group leader in the supervisory order service department. The company also announces the award of the 1942 Westinghouse War Memorial scholarships to five sons of Westinghouse employes. The scholarships were established in honor of the company's 5000 employes who served in World War I. The awards were presented to RUSSELL R. BOYD, Norman, Okla.; ROBERT MORIE, Wilmerding, Pa.; CLARENCE W. WHITMORE III, Kenmore, N. Y.; JOHN H. WRIGHT, North Bergen, N. J.; and FRANCIS E. WYNNE, JR., Wilkinsburg, Pa.

LINK-BELT CO., on June 30, celebrated at the company's Nicetown, Philadelphia, plant what was called the "James Mapes Dodge Day" to pay tribute to the memory of James Mapes Dodge, one of the founders of the Link-Belt Co. Mr. Dodge, who was a prominent engineer and inventor, was, at the time of his death in 1915, chairman of the board of the Link-Belt Co. The celebration marked the ninetieth anniversary of his birth.

GEORGE H. MCBRIDE, for twenty years an employe of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed sales manager of the company's Nuttall Works in Pittsburgh. Mr. McBride succeeds N. C. GOIN, who recently became manager-secretary of the American Gear Manufacturers Association.

S. E. LAUER, president of the York Ice Machinery Corporation, York, Pa., was elected a director of the American Management Association at the recent annual meeting of the Association at the Hotel Pennsylvania, New York City. Mr. Lauer was elected to serve a three-year term.

ERWIN HUBER has been appointed vice-president in charge of sales and advertising for the York Electric & Machine Co., Inc., York, Pa. Mr. Huber has had a wide experience in advertising and sales work.

MEEHANITE METAL CORPORATION, Pittsburgh, Pa., announces that the E. W. BLISS CO., of Brooklyn, N. Y., has been granted the manufacturing rights for Meehanite castings at its foundry in Hastings, Mich.

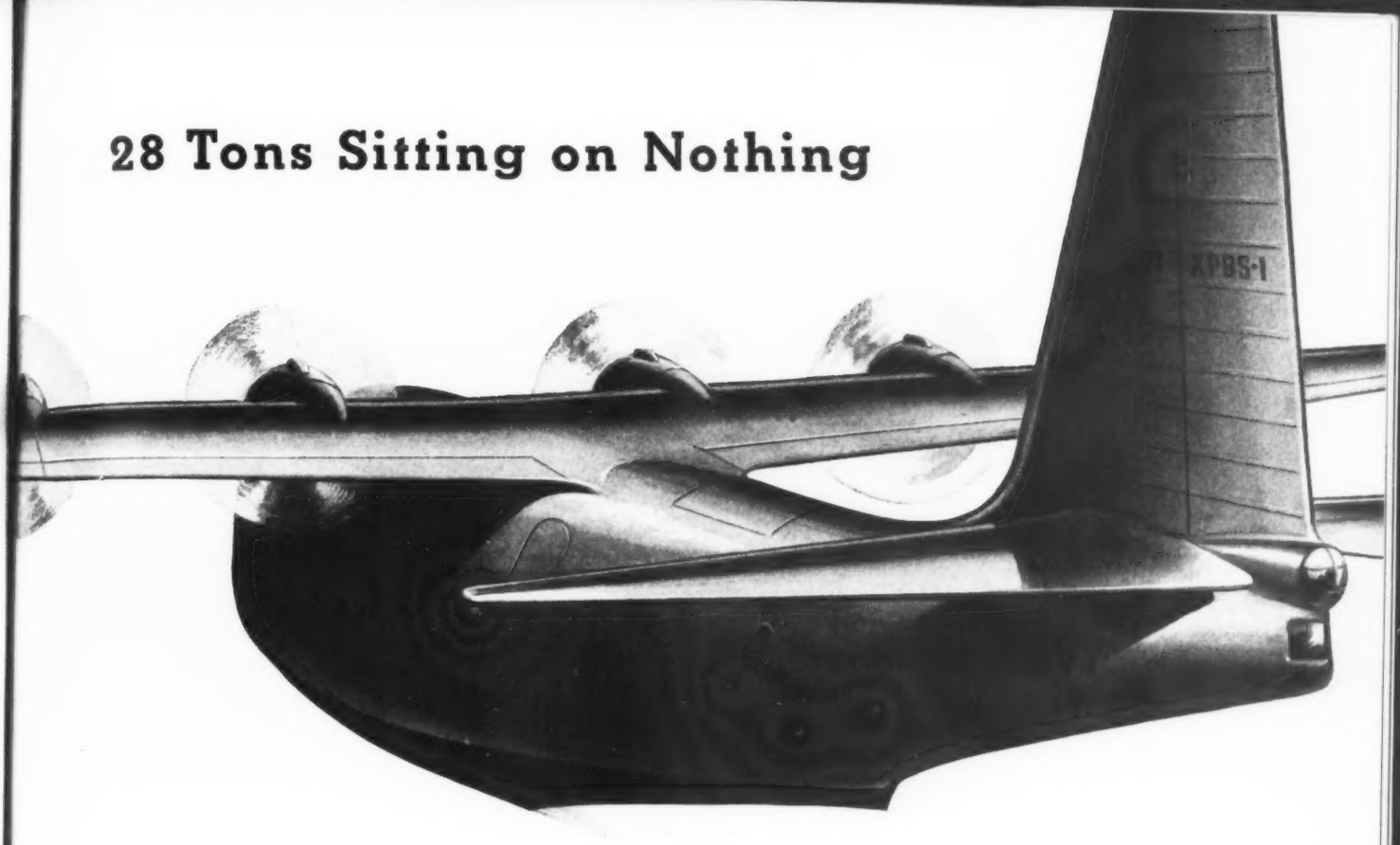
T. ELLWOOD WEBSTER, formerly of the Edward G. Budd Mfg. Co., Philadelphia, Pa., has been appointed general manager, in full charge of operations at the New Castle defense plant, New Castle, Del., Ordnance Division of Edge Moor Iron Works, Inc., Edge Moor, Del.

Wisconsin and Minnesota

JOSEPH A. ELWOOD has been appointed general works manager of the George Gorton Machine Co., Racine, Wis., manufacturer of milling, die-sinking, and engraving machines, tools, and accessories. Mr. Elwood is widely known in machine tool circles. He was one of the founders of the Racine chapter of the American Society of Tool Engineers and a former national committee member and director of the national body. For nineteen years he was associated with the Nash Motors Corporation, serving as division superintendent in charge of tools and production of the Racine division from its inception. Until recently he was factory manager of the Hydraulic Division of the Sundstrand Machine Tool Co. at Rockford, Ill. Upon returning to his home town of

Joseph A. Elwood, New General Works Manager of the George Gorton Machine Co.

28 Tons Sitting on Nothing



TO PULL THIS 28-TON LEVIATHAN into the air—to keep it flying—requires engines of super horsepower—engines that didn't exist, except on a drawing board, not so many months ago.

How the power of 1500 horses can be compressed into an engine hardly wider than your outstretched arm—how this terrific force can be delivered to turn a propeller at the end of a shaft is all a part of America's industrial genius.

A secret of the modern airplane engine's might is gears—gears so light in weight, ground to such close tolerances that engineers almost despaired of ever producing them except under laboratory conditions.

But the urgency of war demanded that these gears be mass produced at no sacrifice in lightness or precision. Today in the plant of Foote Bros. Gear and Machine Corporation these "jewels of power transmission" are flowing out to help power American planes.

All this meant new manufacturing techniques—new production methods. American manufacturers may look forward with confidence to the application of these developments to peacetime speed reducers and gears to assure better machines—quieter machines—produced at lower cost.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS ★ GEARS ★ SPECIAL ASSEMBLIES

Racine, he was welcomed into the Gorton organization by his many friends at a banquet held in his honor.

SAVAGE TOOL CO. announces the removal of its plant and offices from Minneapolis to Savage, Minn. The new plant, erected by this company, is 85 by 225 feet, and is equipped with a metallurgical laboratory for the inspection and analysis of all materials entering into the DoAll precision surface grinders, gages, and other products of the company.

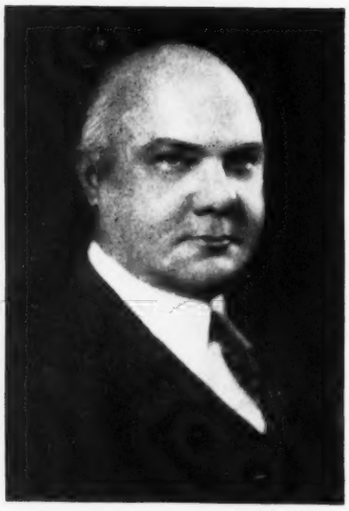
Washington, D. C.

ARTHUR M. HOUSER, engineer of standardization for the Crane Co., Chicago, Ill., has been appointed consultant in the Simplification Branch of the Bureau of Industrial Conservation of the War Production Board, Washington, D. C.

OBITUARIES

Robert F. Runge

Robert F. Runge, vice-president of S K F Industries, Inc., Philadelphia, Pa., died on July 6 in the Germantown Hospital, after a prolonged illness, at the age of fifty-six. Mr. Runge was born in Woodbury, N. J. He graduated from Drexel Institute in 1906, and started to work in the engineering department of the Hess-Bright Mfg. Co., later acquired by the S K F organization. His entire business career was spent with this concern.



Blank & Stoller

Robert F. Runge

Mr. Runge had been a trustee of Drexel Institute since 1935, and had been a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers for many years. He is survived by a brother, Halford, of Haddonfield, N. J., and a sister, Marcella Good, of Philadelphia. His residence was at Alden Park Manor, Germantown.

Hugh Aikman

Hugh Aikman, secretary and publicity manager of J. H. Williams & Co., manufacturers of drop-forgings and drop-forged tools, died at his home in Buffalo on June 20. Death came as the result of heart failure after an illness of seven weeks.

Hugh Aikman

Mr. Aikman was born in Brooklyn, N. Y., March 7, 1870. After completing his education in architecture, he was associated with Carriere & Hastings, prominent New York architects. In 1892, he accepted a position with the Williams company, then located in Brooklyn, completing fifty years of service last February. In 1900, Mr. Aikman was appointed sales manager of the Special Forgings Division, and in 1918, was promoted to the position of advertising manager. In 1920, he was elected secretary and publicity manager of the company. In 1923, when the Brooklyn plant was closed and its facilities consolidated with the present Buffalo factory, Mr. Aikman moved to Buffalo. He served as a member of the Standards Committee of the American Society of Mechanical Engineers.

Mr. Aikman is survived by his widow, Eugenia M. Aikman; two daughters, Mrs. A. Douglas Murphy of Bayonne, N. J., and Miss Margaret Aikman of Buffalo; and a son, Edgerton L. Aikman of Long Island City.

Howard D. Colman

Howard D. Colman, founder and president of the Barber-Colman Co., Rockford, Ill., was killed in an automobile accident on June 25. The accident occurred when a truck collided with the automobile Mr. Colman was driving, killing him instantly. Mr. Colman was born on July 9, 1873, in Waukesha, Wis. He was the son of a Methodist minister, the Reverend Mr. Henry Colman, and his early education was received in various Wisconsin and northern Illinois cities to which his father was assigned.

Mr. Colman was an outstanding inventive genius. In partnership with W. A. Barber, he started the Barber-Colman Co. in Beaver Dam, Wis., in 1891. At that time Mr. Colman was engaged in developing a cotton mill machine. In 1900, he invented a hand-knotter for use in cotton mills, and the firm started manufacturing these machines in Rockford. Two years later the first building was erected on the present Barber-Colman site. Among the machines then manufactured were a warp-tying machine which was said to have revolutionized the cotton mill industry, an automatic spooler, and a high-speed warper. All of these machines were invented by Mr. Colman. Later, the company also engaged in machine tool and small tool manufacture, and became known throughout the industry for its gear-hobbing machines, as well as other machines and tools.

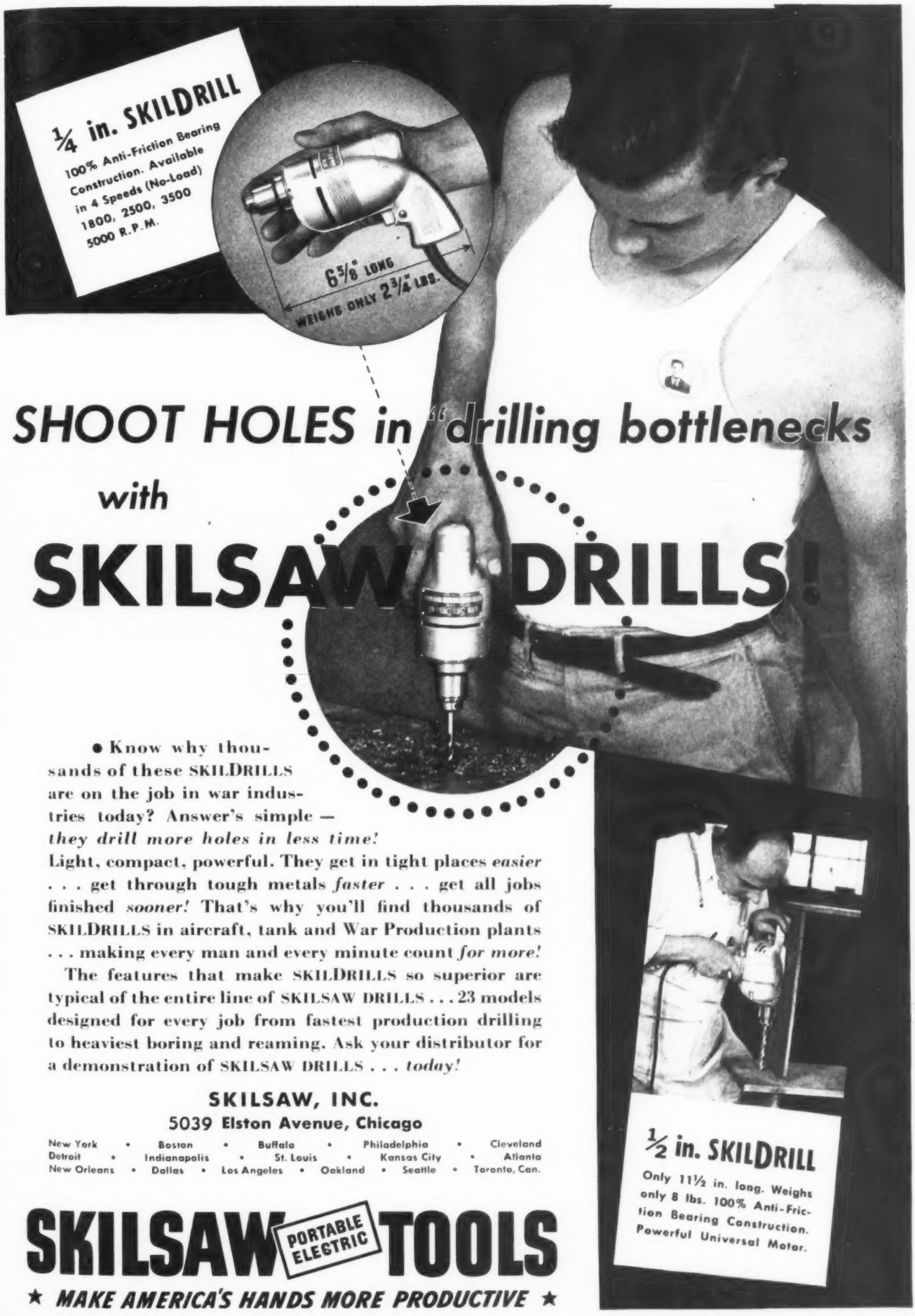
Mr. Colman was married in June, 1902, to Bertha Maguire. Besides his widow, he is survived by two sons and two daughters.

Philip D. Block

Philip D. Block, former president and chairman of the executive committee of the Inland Steel Co., Chicago, Ill., died on June 30 at the Presbyterian Hospital in Chicago at the age of seventy-one years. Mr. Block had been president of the company for twenty-two years, and chairman of the executive committee since April, 1941. He was the last surviving founder of the Inland Steel Co., which he was active in organizing forty-nine years ago, together with his father, Joseph Block, and the late George H. Jones.

On November 10, 1893, Philip Block was elected director and treasurer of the company. In January, 1894, he added the duties of purchasing agent to his activities, and on July 9, 1901, was made vice-president, also continuing to fill the post of treasurer. Eight years later he was elected first vice-president, and in 1919 he became president.

For half a century, Philip D. Block was the cornerstone of the Inland Steel Co. In 1901, he was the main


1/4 in. SKILDRILL
100% Anti-Friction Bearing Construction. Available in 4 Speeds (No-Load) 1800, 2500, 3500 5000 R.P.M.
6 5/8" LONG
WEIGHS ONLY 2 3/4" LBS.

SHOOT HOLES in "drilling bottlenecks with SKILSAW DRILLS!

● Know why thousands of these SKILDRILLS are on the job in war industries today? Answer's simple — *they drill more holes in less time!* Light, compact, powerful. They get in tight places *easier* . . . get through tough metals *faster* . . . get all jobs finished *sooner!* That's why you'll find thousands of SKILDRILLS in aircraft, tank and War Production plants . . . making every man and every minute count *for more!*

The features that make SKILDRILLS so superior are typical of the entire line of SKILSAW DRILLS . . . 23 models designed for every job from fastest production drilling to heaviest boring and reaming. Ask your distributor for a demonstration of SKILSAW DRILLS . . . *today!*

SKILSAW, INC.
5039 Elston Avenue, Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland
Detroit • Indianapolis • St. Louis • Kansas City • Atlanta
New Orleans • Dallas • Los Angeles • Oakland • Seattle • Toronto, Can.

SKILSAW PORTABLE ELECTRIC TOOLS

★ *MAKE AMERICA'S HANDS MORE PRODUCTIVE* ★

1/2 in. SKILDRILL
Only 11½ in. long. Weighs only 8 lbs. 100% Anti-Friction Bearing Construction. Powerful Universal Motor.

factor in starting the company's principal plant at Indiana Harbor, Ind. During the difficult years that followed, he virtually lived at this plant. Through his untiring efforts, ably assisted by those of his brother, L. E. Block, the Inland Steel Co. rose from a modest beginning to one of the largest steel companies of today.

Mr. Block was a director of the First National Bank in Chicago, but had few other business interests, devoting his full life to the development of the Inland Steel Co. He served his industry for many years on committees of the American Iron and Steel Institute, and was well known for his strong leadership. He is survived by his wife; a son, Philip D., Jr.; and a daughter, Mrs. Madeline Block Straus.

William W. Anderson

William Wybrants Anderson, for two years domestic sales manager of the Nicholson File Co., died on July 18 at the Homeopathic Hospital, Providence, R. I., after a short illness. His affiliation with the Nicholson File Co. began in Canada after the first World War, and he had been with the firm in Canada and the United States since.

Mr. Anderson was born in Londonderry, Ireland, on October 21, 1883, and came to Canada in 1902. During the first World War he served with the Canadian Army, entering the service in 1915 and being discharged in 1919. He became an employe of the Nicholson File Co. at Port Hope, Ontario, and worked up to sales manager of the Canadian works, a post he held five years before going to Providence in 1940 to assume the position he held at the time of his death. He was also a director of the company.

In 1906 he married Lillian Lightwood, who survives him. He is also survived by a daughter.

S. Houghton Cox, vice-president and a director of the Cleveland Twist Drill Co., Cleveland, Ohio, died in Pasadena, Calif., on July 12. Up to the time of his death, Mr. Cox had served as a director, although he was not actively engaged in the conduct of the business, which was founded by his father, the late Jacob D. Cox II, in 1876. His younger brother, Jacob D. Cox III, is president and general manager of the company.

Earl Comstock Moss, district manager of the Morse Chain Division of the Borg-Warner Corporation, Chicago, Ill., died on July 8 at the age of seventy-one. He was the oldest active employe of the Morse Chain Division, and had spent practically all of his life as a pioneer designer and sales engineer of power transmission equipment.

COMING EVENTS

October 12-16—National Metal Congress and Exposition in Cleveland, sponsored by the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland.

October 12-16—Annual meeting of the American Welding Society at the Hotel Cleveland in Cleveland, Ohio; headquarters of the Society, 33 W. 39th St., New York City.

October 16-17—Tenth semi-annual meeting of the American Society of Tool Engineers, to be known as the War Production Conference of the Society, at Springfield, Mass., with headquarters at the Hotel Kimball. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

November 24-29—National Chemical Exposition and Industrial Chemical Conference at the Sherman Hotel, Chicago, Ill. For further information, address National Chemical Exposition, 110 N. Franklin St., Chicago, Ill.

November 30-December 3—Annual meeting of the American Society of Mechanical Engineers at the Hotel Astor, New York City. Secretary, C. E. Davies, 29 W. 39th St., New York City.

November 30-December 5—Fifteenth National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

* * *

Australia Forges Ahead in War Production

Although all of Australia has a population of only 7,500,000, the industries of the country are turning out great amounts of war material. Some of this material is turned out on a large scale, while, in other cases, the volume of each item is limited; but the total output is greatly to the credit of a country with so comparatively small a population.

Practically everything required for modern warfare is made. Artillery equipment is turned out in great quantities, as well as rifles, machine guns, and small arms ammunition. A machine gun occupying an extremely small space when shipped or carried has been developed and is manufactured at a very low price, indicating the efficiency of the manufacturing operations.

One point that might be emphasized is that the Australian engineers and ordnance designers have had the courage to make use of new methods and new developments whenever possible. For example, in the machine gun mentioned, a great many parts that are not subject to excessive strain are made from die-castings; other parts that are customarily machined to shape are produced from stampings.

* * *

Van Norman Wins Army and Navy Star

In a ceremony broadcast over a national hook-up, the Army and Navy Star recently was raised over the plant of the Van Norman Machine Tool Co., in Springfield, Mass. This special award, given only to those manufacturers who have made outstanding records in producing materials for the Army and Navy, was conferred jointly by Under Secretary of War Robert P. Patterson and Under Secretary of the Navy James V. Forrestal. The presentation was acknowledged by James Y. Scott, president of the company. The Van Norman Machine Tool Co. is among the first eighteen machine tool builders to win this particular award.

* * *

DeLaval Steam Turbine Co. Receives Navy "E" Award

For outstanding achievement in the production of turbines, pumps, gears, and other vital equipment for the United States Navy, the DeLaval Steam Turbine Co., Trenton, N. J., has been awarded the Navy "E." The ceremonies took place on June 29, when Rear Admiral William Carleton Watts made the presentation to H. L. Watson, executive vice-president of the company. They were held in the War Memorial Building at Trenton, and were attended by about 1800 employes and guests. Since 1901, the DeLaval company has been specializing in turbines, gears, pumps, and other rotating machinery.

* * *

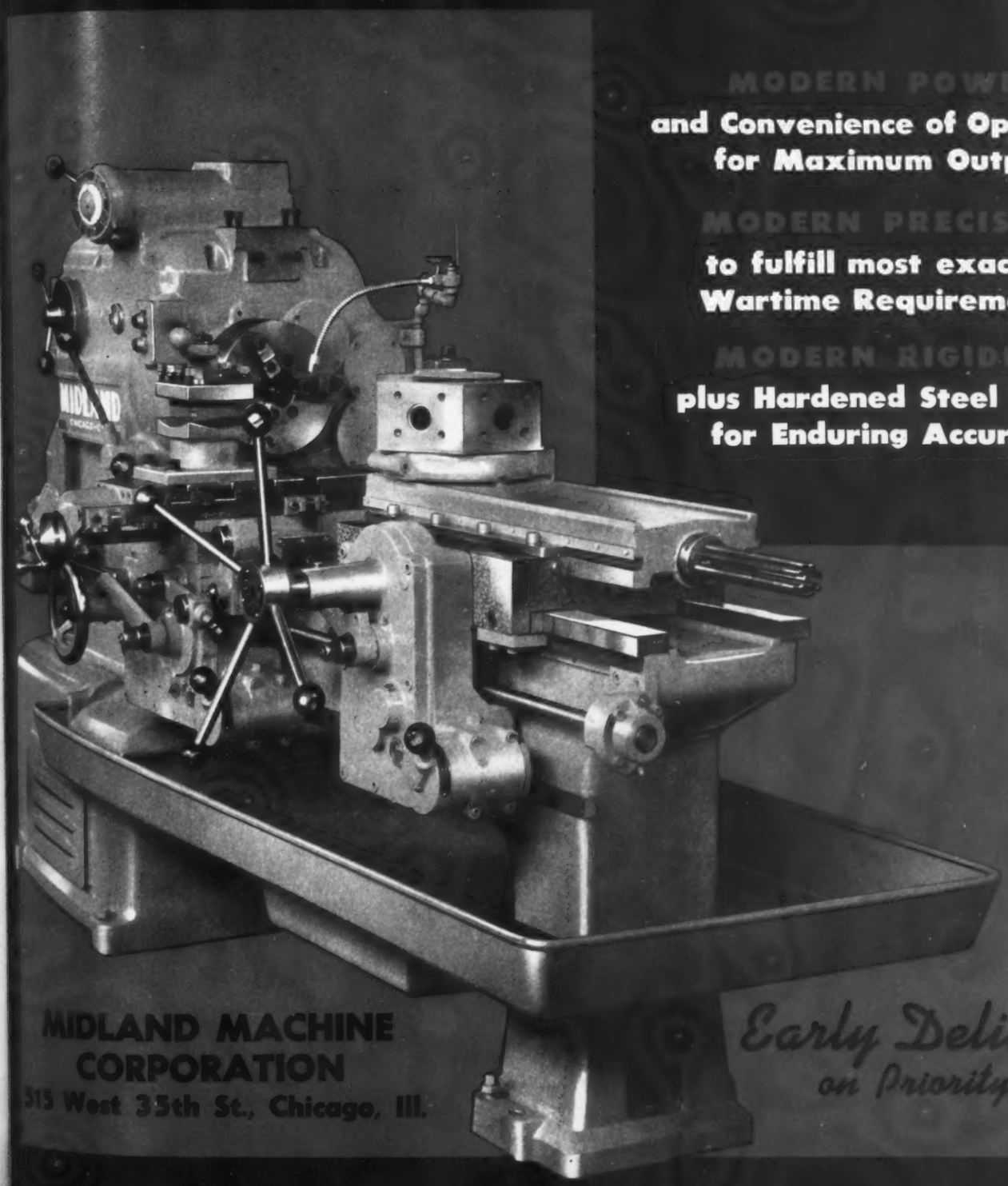
Skid-Preventing Oil Absorbent

A new type of fireproof and skid-preventing oil absorbent has been brought out by the Waverly Petroleum Products Co., Drexel Bldg., Philadelphia, Pa. The new product, called "Speedi-Dri," is a granular substance with such affinity for oil and grease that its regular use will not only remove old stains from floors, but also prevent new accumulations.

AUGUST 1942—FORTY-EIGHTH YEAR

AUG 8 1942

MACHINERY



MODERN POWER
and Convenience of Operation
for Maximum Output

MODERN PRECISION
to fulfill most exacting
Wartime Requirements

MODERN RIGIDITY
plus Hardened Steel Ways
for Enduring Accuracy

MIDLAND MACHINE
CORPORATION
515 West 35th St., Chicago, Ill.

Early Deliveries
on Priority Orders

MIDLAND TURRET LATHES

What is Your G.I.Q.?

(GAGE INTELLIGENCE QUOTIENT)

Standard "Not Go" Ring Gage

Standard "Go" Plug Gage

YOU can buy and use gages to better advantage if you can answer *all* these questions correctly. How about it?

Correct answers are printed below—upside down.

1 Is a gage a measuring device? . . . . . .

2 Define "Limits". . . . . .

3 What is "Tolerance"? . . . . . .

4 What is "Allowance"? . . . . . .

5 There are two general classes of gages, Working and Inspection Gages. When is each class used?

6 Which holds the product to the closer limits? . . . . . .

ANSWERS

1 Not actually: "Go" and "Not Go" Gages compare the size of the product with its predetermined maximum and minimum limits.

2 *Limits* are the maximum and minimum dimensions of a part.

3 *Tolerance* is the permissible variation between the maximum and minimum limits of the product.

4 *Allowance* is the amount of intentional difference between mating parts. *Positive allowance* provides clearance, *negative allowance* provides interference.

5 Working Gages are used by the operator working on the product and Inspection Gages are used by the Inspector who passes the product.

6 Working Gages.

This is one of a series of advertisements published by Greenfield Tap & Die Corporation to help users get greater production from their small tools in these critical times, through making useful facts more widely known

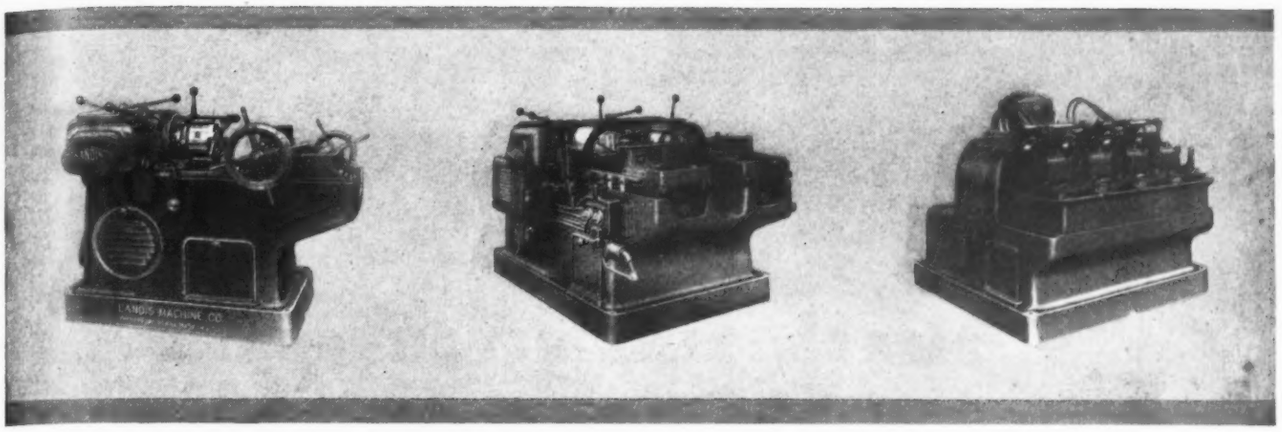
Write us for extra copies of this page, or for additional information.

GREENFIELD TAP AND DIE CORPORATION • GREENFIELD, MASS.

Detroit Plant 5850 Second Blvd — Warehouses in New York, Chicago and Los Angeles
In Canada Greenfield Tap and Die Corp. of Canada, Ltd., Galt, Ont.

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS



Modern Tools for the National Emergency

—In Threading it's LANDIS—LANDMACO

1½R Shell Tappers and LANDMACO Threading Machines are used by almost every manufacturer for handling the threading of munitions components. These machines will handle difficult thread cutting operations on an unusually high production basis with assured Thread Accuracy.

The increased demand for More Production requires machines which are capable of producing **more**—with minimum rejections, and at lowest possible cost—Investigate the LANDMACO as applicable to your Threading requirements—Write for Bulletin No. H-75.

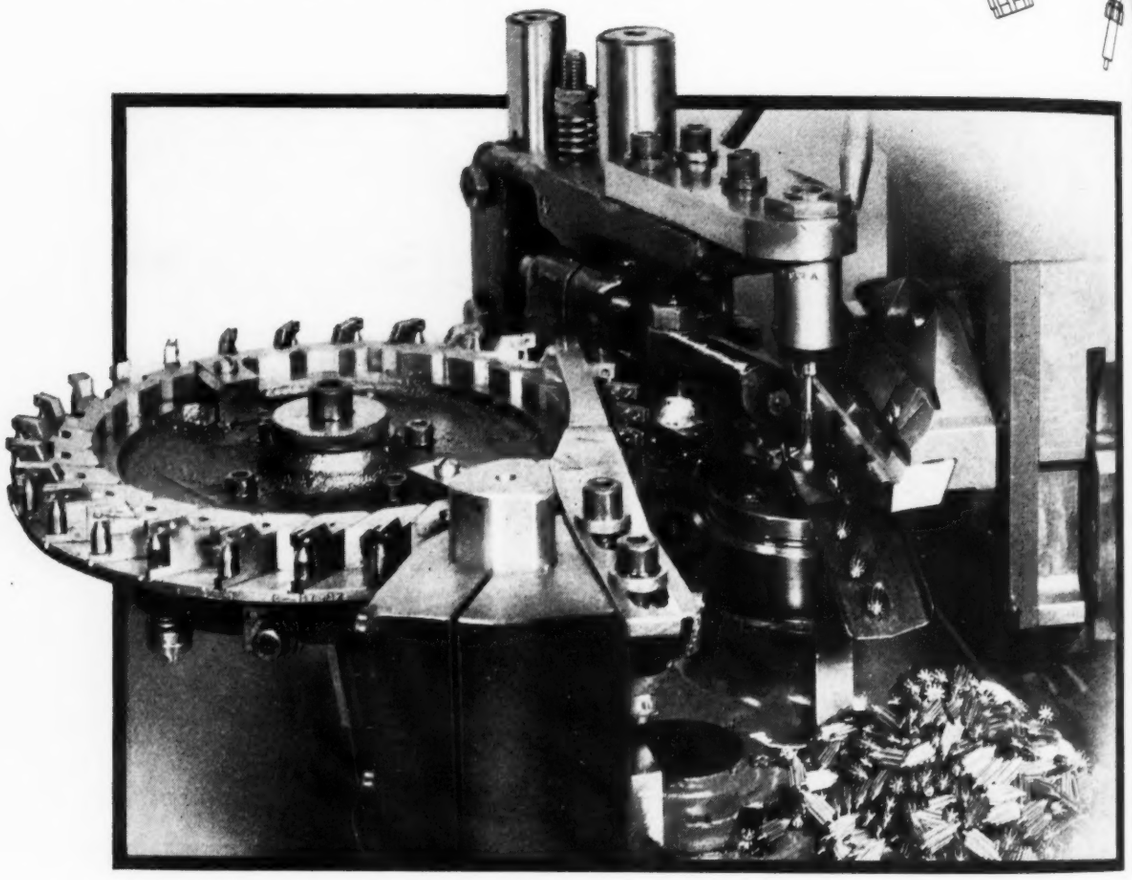
The LANDIS Line

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

—and the LANDIS Precision THREAD GRINDER

LANDIS MACHINE COMPANY, Waynesboro Pennsylvania

SMALL, FINE-PITCH GEARS



Magazine loading is particularly well suited to the handling of stem pinions, or thin blanks, when ganged on arbors. Work is loaded in magazine by hand, but is automatically ejected. Note the STRAIGHT LINE Cutter which for tiny pinions is made with "gaps" rather than with a continuous row of teeth.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

PRECISION CUT *FASTER*

THAN WITH SUB-PRESS DIES . . .

The Fellows STRAIGHT-LINE GEAR GENERATOR employs a rack-type cutter, which is admirably suited to the generating of a variety of gear-tooth forms, in addition to those of involute shape. When equipped with a magazine feed, this machine produces gears and other parts at a phenomenal rate of speed.

A further advantage of this machine is that it is especially suited to the cutting of small fine-pitch pinions, for which work the rack is made with a series of rows of teeth separated by gaps. Sharpening of the cutter, especially when provided with straight, or spur teeth, is a simple job of surface grinding.

These machines are used extensively for cutting gears for clocks, cameras, dial indicators, range finders, time fuses, etc. . . . For descriptive catalog, write The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, Michigan, or 640 West Town Office Building, Chicago, Illinois.

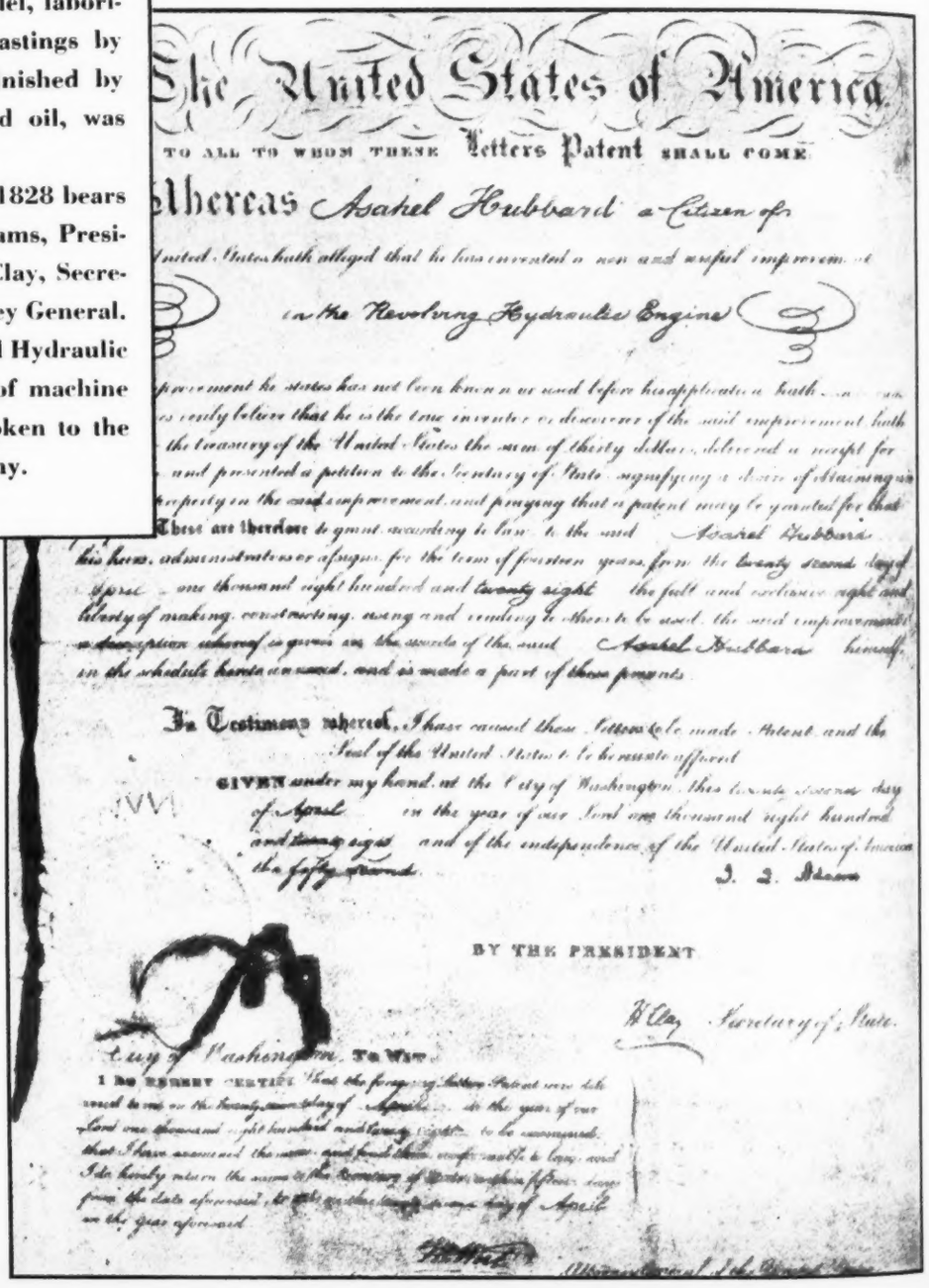
Method

. . . . FROM BLANK TO FINISHED GEAR

JOHN QUINCY ADAMS

At his watermill in the West Parish, Asahel Hubbard experimented with his "Revolving Hydraulic Engine." Models made of wood were tested, rejected, modified and refined. At last a working model, laboriously formed from rough iron castings by the lost art of "chipping" and finished by grinding with powdered glass and oil, was assembled and found successful.

The patent granted April 22, 1828 bears the signatures of John Quincy Adams, President of the United States, Henry Clay, Secretary of State, William Wirt, Attorney General. This marks the birth of the National Hydraulic Company beginning a long chain of machine industries that comes down unbroken to the Jones & Lamson Machine Company.



The United States of America

TO ALL TO WHOM THESE Letters Patent SHALL COME

Whereas Asahel Hubbard a Citizen of

United States hath alleged that he has invented a new and useful improvement

in the Revolving Hydraulic Engine

improvement he states has not been known or used before his application hath

verily believes that he is the true inventor or discoverer of the said improvement hath

the treasury of the United States the sum of thirty dollars, delivered a receipt for

and presented a petition to the Secretary of State signifying a desire of obtaining a

property in the said improvement and praying that a patent may be granted for that

These are therefore to grant according to law to the said Asahel Hubbard

his heirs, administrators or assigns for the term of fourteen years from the twenty second day

of April one thousand eight hundred and twenty eight the full and exclusive right and

liberty of making, constructing, using and vending to others to be used, the said improvement

a description whereof is given in the words of the said Asahel Hubbard himself,

in the schedule hereto annexed, and is made a part of these presents.

In Testimony whereof, I have caused these Letters to be made Patent and the

Seal of the United States to be hereunto affixed.

GIVEN under my hand, at the City of Washington, this twenty second day

of April in the year of our Lord one thousand eight hundred

and twenty eight and of the independence of the United States of America

the fifty second.

J. Q. Adams

BY THE PRESIDENT

H Clay Secretary of State.

City of Washington, To Wit:

I DO HEREBY CERTIFY, That the foregoing Letters Patent were delivered

unto me on the twenty second day of April in the year of our

Lord one thousand eight hundred and twenty eight to be examined,

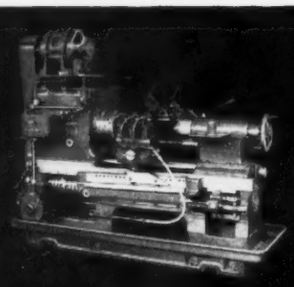
that I have examined the same and found them conformable to law; and

I do hereby return the same to the Secretary of State within fifteen days

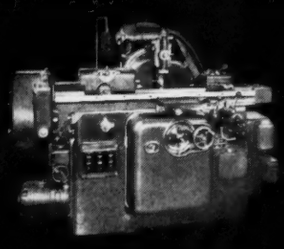
from the date aforesaid, to wit on the twenty second day of April

in the year aforesaid.

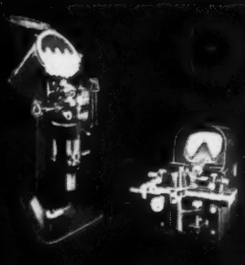
Attorney General of the United States



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

Signed our BIRTH CERTIFICATE

OUR determination to test, reject, modify and refine, links us with the past and points ahead into the future. Whenever invention born of necessity in a time of emergency has developed new materials or new methods, we at Jones & Lamson have been ready with advanced machine tool technique, and those who have depended on us have not been let down.

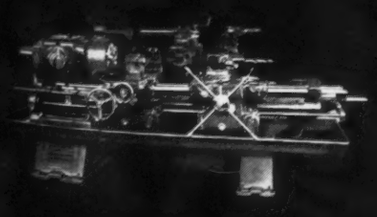
No matter how preoccupied with today's production problems, you cannot fail to benefit by contacting a company that has so consistently maintained leadership. Whether your organization is large or small your inquiry will receive the careful, detailed study of our engineers.

Send your questions today and ask for our illustrated catalogs.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, Vermont
U. S. A.



SADDLE TYPE
UNIVERSAL TURRET LATHE

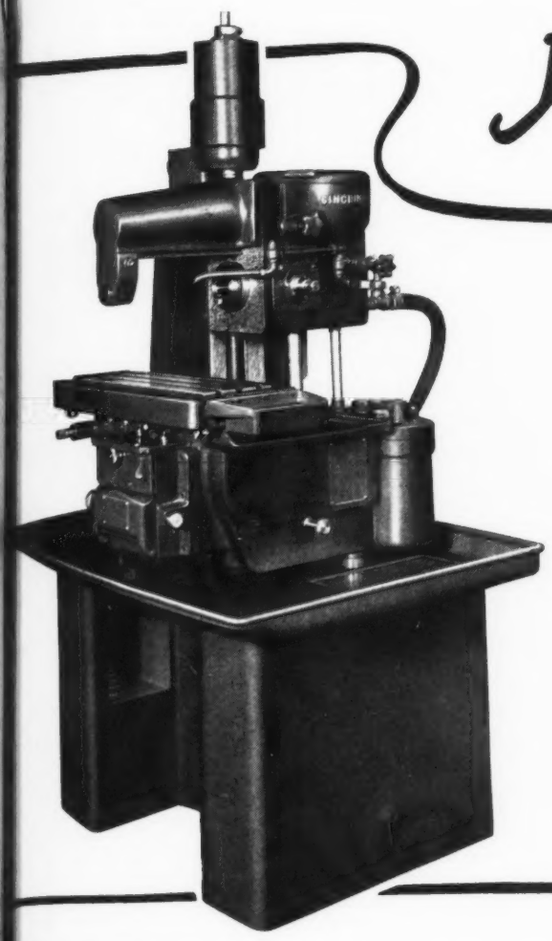
PROFIT PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHE

CINCINNATI No. 0-8 Plain Automatic Milling Machine equipped with automatic Rise and Fall Spindle Carrier, set up for milling two Woodruff keyways in flap-control gear shafts. Both keyways are milled on diameters of the same size.

WIN *with a Cincinnati!*

if it's FLEXIBILITY you want!



We have proved right in our own shops that No. 0-8 Millers are extremely flexible and fully capable of handling a wide range of small parts fast, accurately and automatically. Here, No. 0-8 Milling Machines equipped with automatic Rise and Fall Spindle Carrier are producing many parts for other machines; parts that must be turned out fast and milled to mighty close tolerances. These No. 0-8 Millers are out-performing many other types of machines as much as two to one. And all over the country hundreds of users are reporting similar experiences.

We are confident CINCINNATI No. 0-8 Plain Automatic Milling Machines will step up your small parts production. Investigate NOW! Send for specification catalog M-964 which gives details on all features and their benefits. Write today!

BUY Cincinnati No. 0-8 Plain Automatic Milling Machines

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

IF IT'S *Flexibility* YOU WANT

BUY CINCINNATI UNIVERSAL HYDRAULIC GRINDING MACHINES

CINCINNATI engineers have developed and incorporated in the construction of Hydraulic Universals many unusual features which have contributed to the usefulness of these grinding machines, and have made them capable of handling an exceedingly wide range of toolroom grinding and general manufacturing work.

Take a look at these features, many of them exclusive, and compare with other makes: FILMATIC Grinding Wheel Spindle Bearings; Hinged Type Internal Grinding Attachment *driven by independent motor;* Infinitely Variable Work Speeds; Accuracy of Table Reversal within .004"; Dog-Controlled Table Reciprocation from 3/32" to Full Table Stroke; Independent Right and Left Hand Cross Traverse; Two-Speed Hand Cross Traverse; Table Ways protected by Telescopic Guards; Foolproof Lubrication. And these are not all.

There's much less likelihood of operator fatigue because every element of manipulation is designed for ease of operation and conveniently placed within easy reach of the operator's normal working position. And here's another important consideration: *maintenance has been practically eliminated.* On these grinding machines accuracy is easily and quickly achieved . . . a limit of .0001" being practical even after years of operation.

You're going to find that CINCINNATI Hydraulic Universal Grinding Machines will give you Faster Set-Up, Faster Handling, Faster Grinding, and Faster Sizing. You'll find them extremely flexible, easy to handle, and capable of turning out twice as much work as older type machines. They are sturdily built, well able to meet not only today's production demands, but to give continuous, unfailing performance for many years to come.

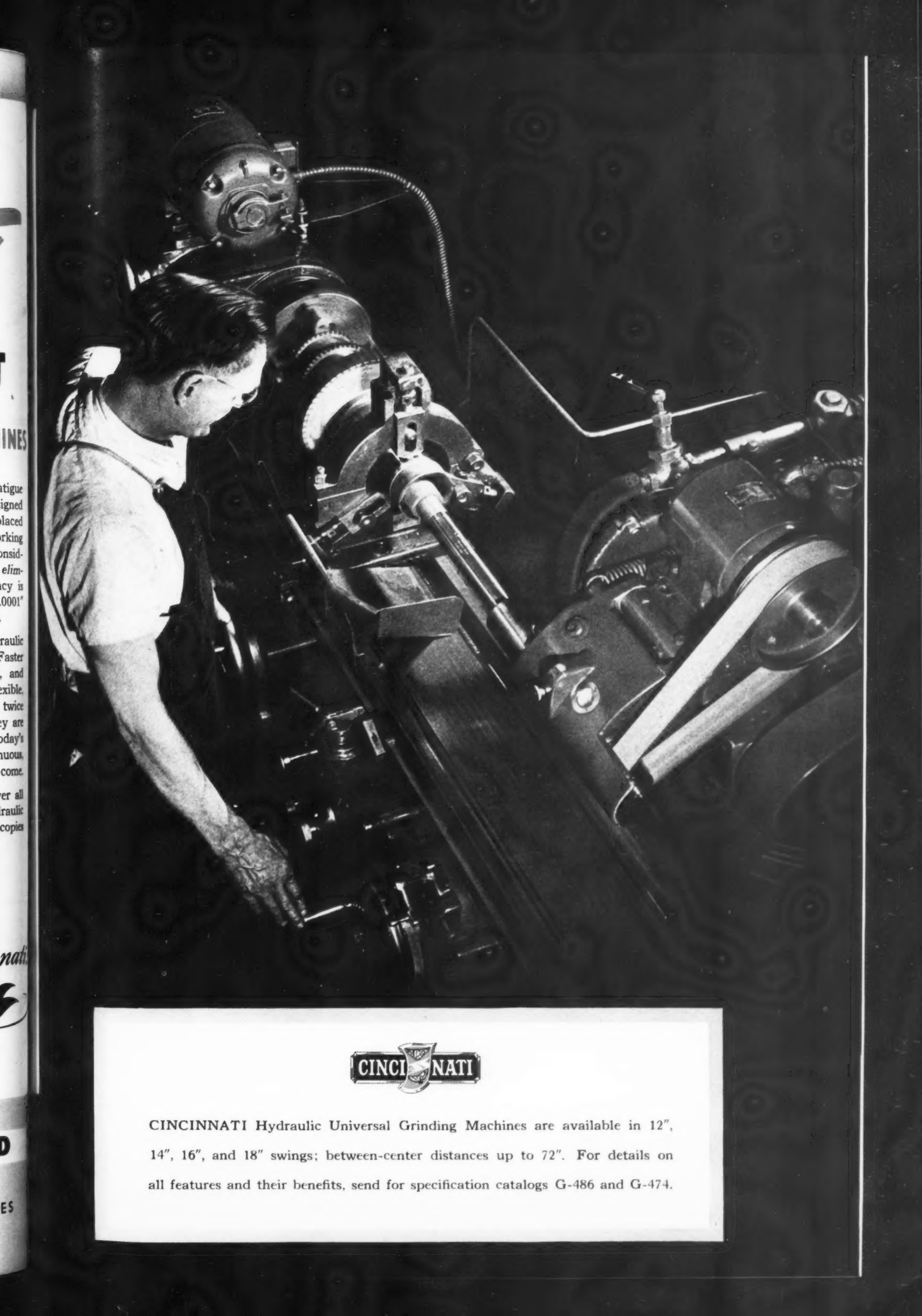
Specification catalogs G-486 and G-474 cover all details and benefits of CINCINNATI Hydraulic Universal Grinding Machines. Send for your copies of these informative catalogs today.

WIN *with a Cincinnati*

CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES



CINCINNATI

CINCINNATI Hydraulic Universal Grinding Machines are available in 12″, 14″, 16″, and 18″ swings; between-center distances up to 72″. For details on all features and their benefits, send for specification catalogs G-486 and G-474.

This multiple spindle machine is used to rough-and-finish cut the bottom, sides and dovetails of milling machine tables . . . In one "pass" through the machine, it performs a number of machining operations at high speed and with unusual precision. It eliminates many operations formerly requiring several separate machines . . . This unit is another of many specialized production machines designed and developed by Kearney & Trecker engineers to manufacture their own product — Milwaukee Milling Machines — in volume and to the highest standards of machine tool accuracy.

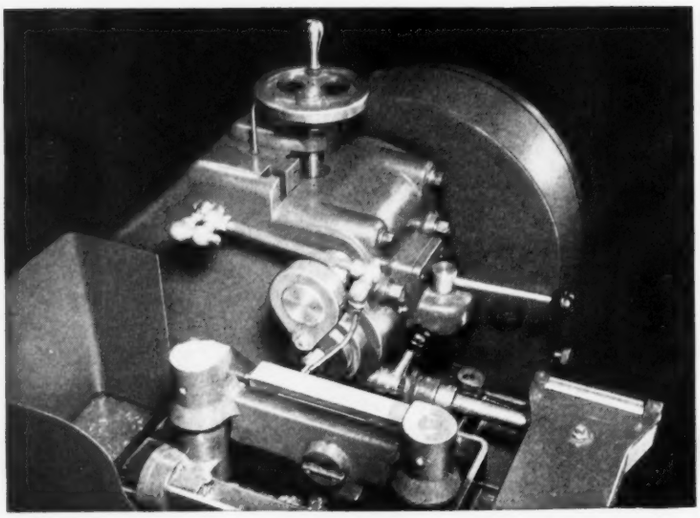
Milwaukee MACHINE

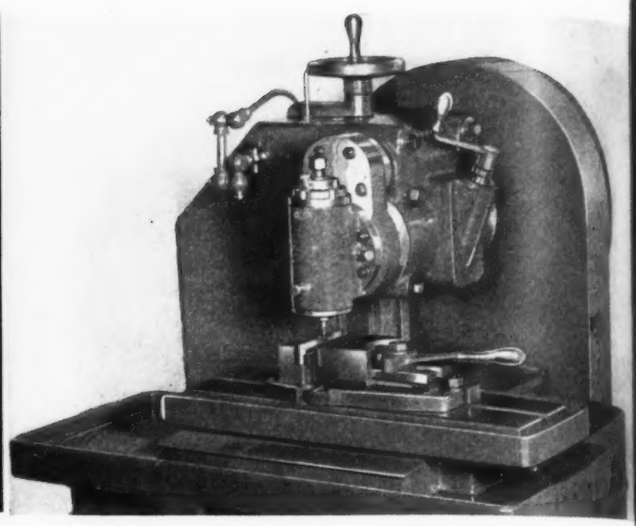
Rapid training of milling machine operators is an acute need today. As an aid in that direction we offer "Milling Practice" — a visual training course that has proven of real value and is in use throughout the country. For information — write our Department of Industrial Education.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

KEARNEY & TRECKER
CORPORATION

T O O L S





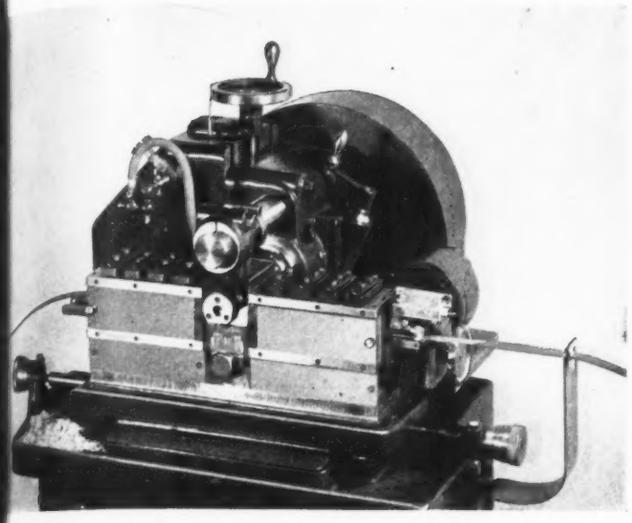
U.S. *Multi* MILLERS

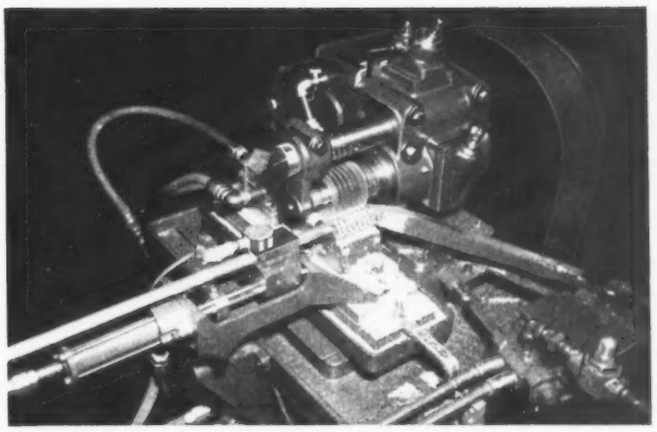
SPECIFIED FOR

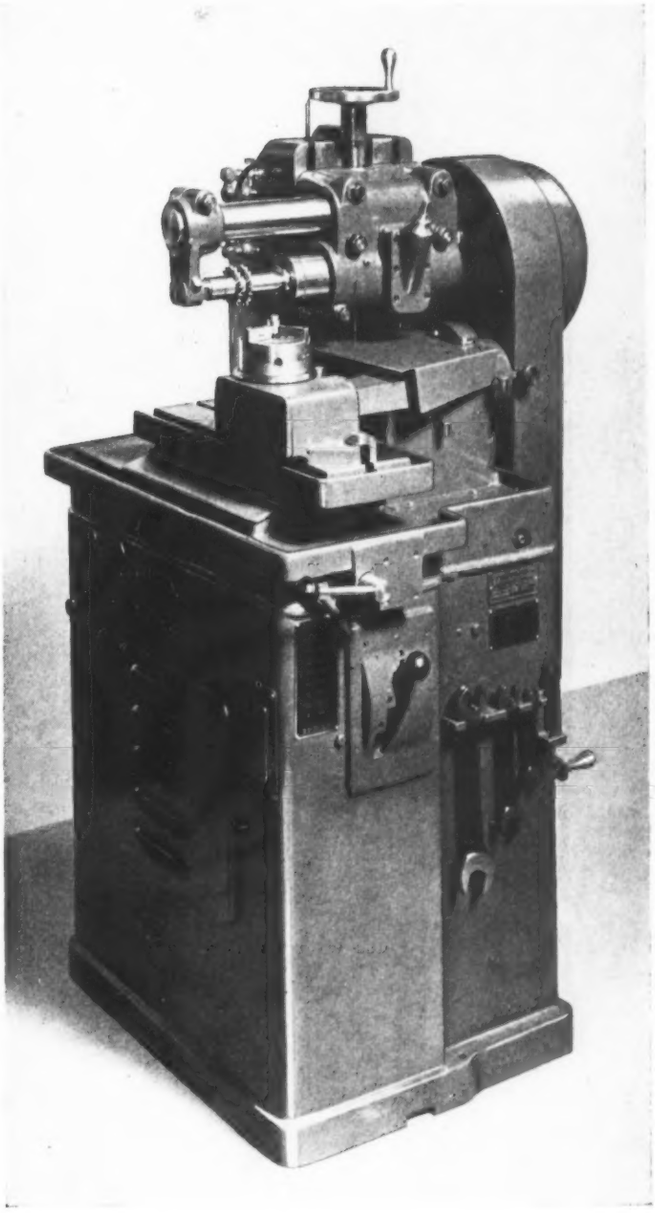
MUNITIONS PRODUCTION

U. S. Multi Millers are specified for more than 200 separate operations on parts for a single aircraft engine . . . they're applied for production of various parts of aircraft cannon . . . for rifle parts . . . fuses . . . small arms parts . . . machine gun parts . . . anti aircraft gun parts . . . and numerous other munitions units. Typical set-up illustrations on these pages show how effectively the U. S. Multi Miller functions in war production; one inexperienced operator can handle a large battery of these versatile milling machines, easily maintaining the specified close tolerances so vital to interchangeability. U. S. Multi Millers are practicable for short lot jobs as well as long run jobs. All features are illustrated and described in Bulletin 60M. Send for your copy today.

U. S. TOOL COMPANY, INC.



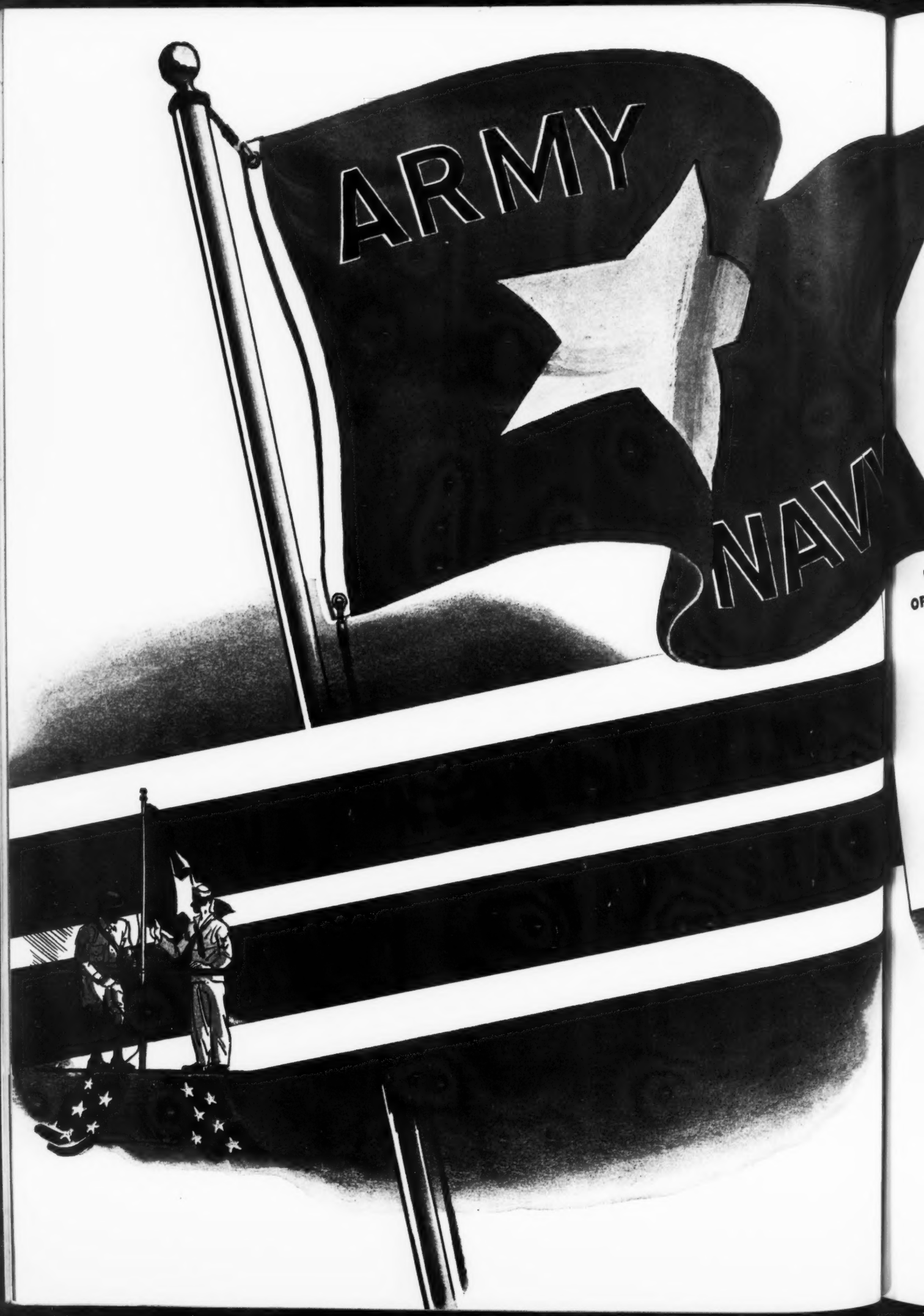




Illustrated left to right: CONTOUR MILLING parts for rifle—milling closed slot in receiver unit. STEP MILLING on fuse part—vertical head and quick operating cam vise for 2-level cut in single set up. CONTINUOUS MILLING form stock for gun and fuse parts. CUT-OFF of fuse parts from bar stock —automatically operated fixture and stock feed. Right: Full view of U. S. MULTI MILLER set up for index milling — hex or square milling of aircraft parts fully automatic. Cam-controlled action provides for high speed and accurate index milling — grinding — vertical milling — spur gear cutting — hand milling—automatic cut off—continuous milling of bar and coil stock—rotary milling—contour milling—climb milling—blind milling.

PRODUCTS

Ampere, (East Orange), N. J.


ARMY
NAVY

IN ACKNOWLEDGING THE AWARD TO HIS COMPANY OF THE ARMY AND NAVY STAR, VAN NORMAN PRESIDENT JAMES Y. SCOTT SAID IN PART:

"... this flag is more than just a flag. It symbolizes the tie that today exists between the fighting men of our Army and Navy and the fighting men and women of our labor battalion. It is a symbol of a new, greater spirit ... of unity, of devotion, of loyalty and determination in the cause of victory which we must and shall have, and a unity of thought between all sections of our people in serving their country."

This burgee was recently raised over the Van Norman plant in recognition of the company's record in producing milling machines and oscillating radius grinders for war-production plants, and automotive service machines for the armed forces.

To the last man and woman now wearing the Star button, Van Norman regards this insignia as a challenge for the future ... to top the highest former levels of production. And this challenge will be met ... for Van Norman will keep on earning the Army and Navy Star every hour of every day, until Victory is final and complete.

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

To Finish The Job Quicker . . .

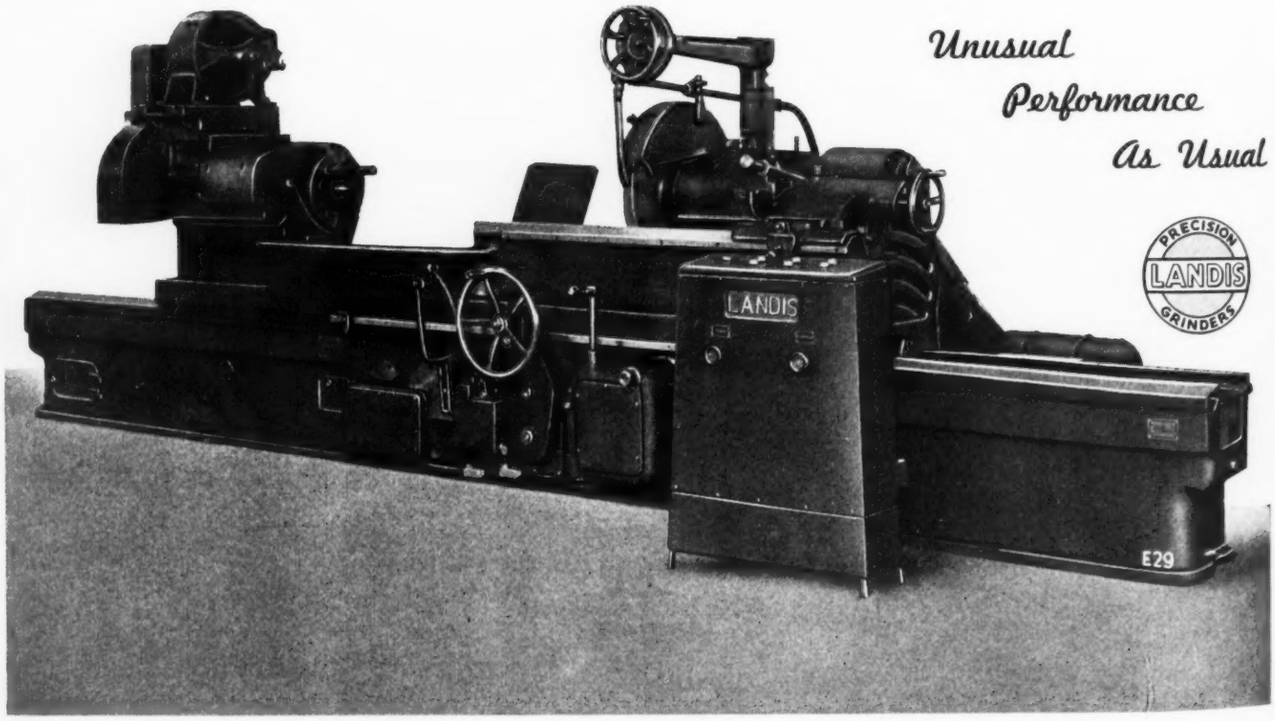
A TANK MANUFACTURER USES A LANDIS LIKE THIS

That valuable time can be saved by the proper choice of grinding equipment is illustrated by a large corporation engaged in the manufacture of tanks.

This corporation employs a Landis 16" x 96" Type B Plain Hydraulic Grinder with a gapped table for the grinding of tank gun rotors measuring 30" in diameter. Ordinarily such parts would require a machine of over 30" swing, however, because the rotors are short in length and are relatively light, and because the gapped table allows work as large as 40" in diameter to be accommodated they can be ground on the 16" swing machine.

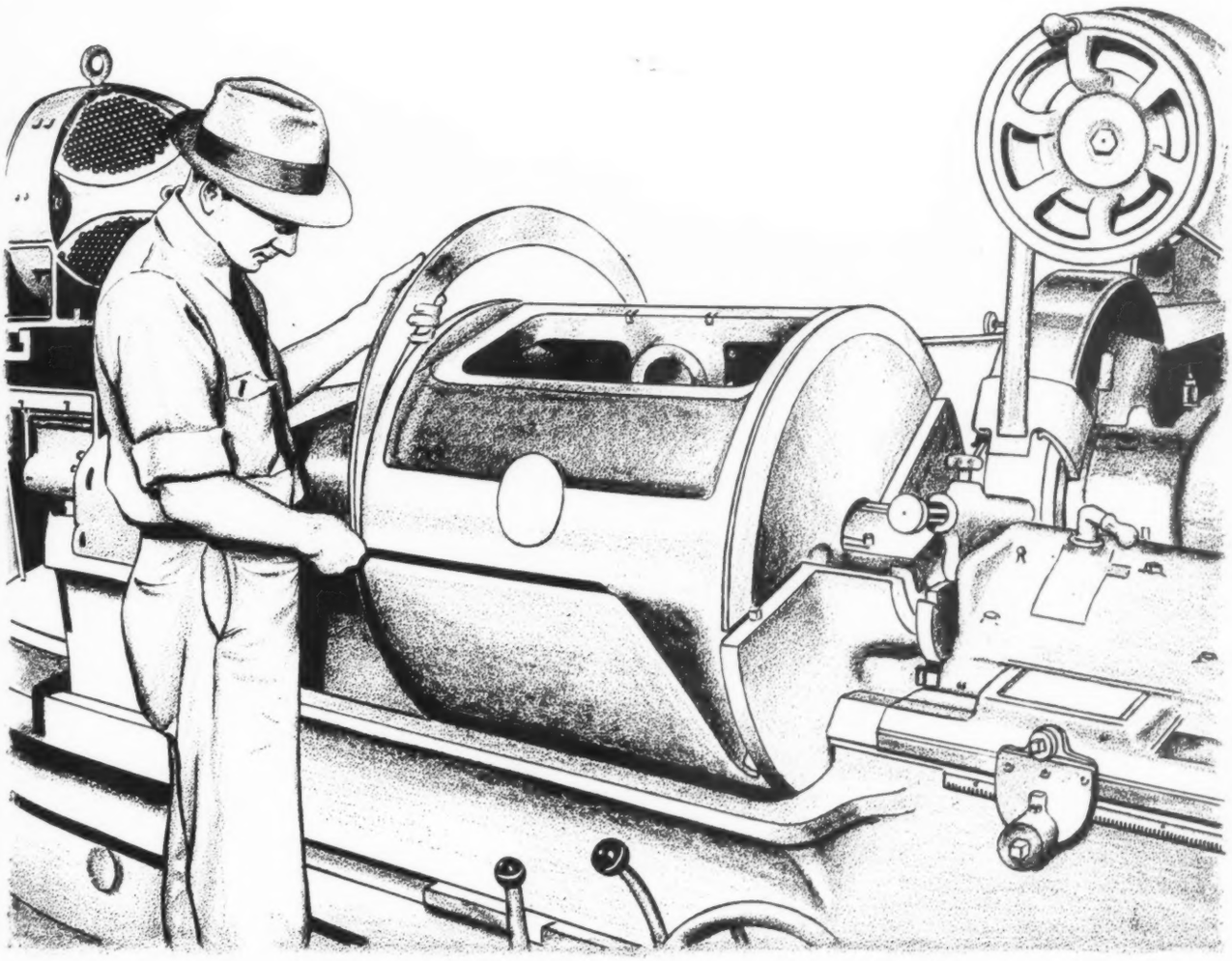
The time saving features of such an arrangement are obvious. On the 16" grinder handling time is reduced to a minimum because the work can be speedily set up with no waste machine nor space. In addition the very compactness of the machine plus the handiness of controls reduce operating fatigue and increase efficiency. Both short and long work with or without projections can be ground.

Why not avail yourself of many years experience in the field of precision grinding by asking Landis for recommendations. Then you, too, may find yourself benefiting from added grinder production.



Unusual Performance As Usual

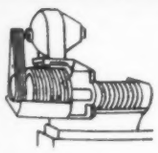
PRECISION LANDIS GRINDERS



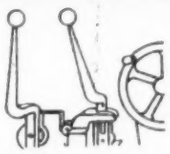
Above is shown the Landis 16"x 96" Type B Plain Hydraulic Grinder now being used by a large corporation for the grinding of tank gun rotors. The work table is gapped at the headstock end to accommodate work 40" in diameter. The gap is 34" in width. When grinding, the rotor is mounted on a special fixture equipped with blocks on the ends to receive the centers of the headstock and footstock.

This 16"x 96" Type B is provided with a fill piece for the gap so that the machine can be used for grinding other parts when not being used to grind rotors.

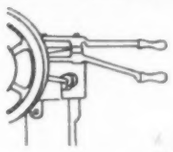
LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.



MULTIPLE V BELT HEADSTOCK DRIVE

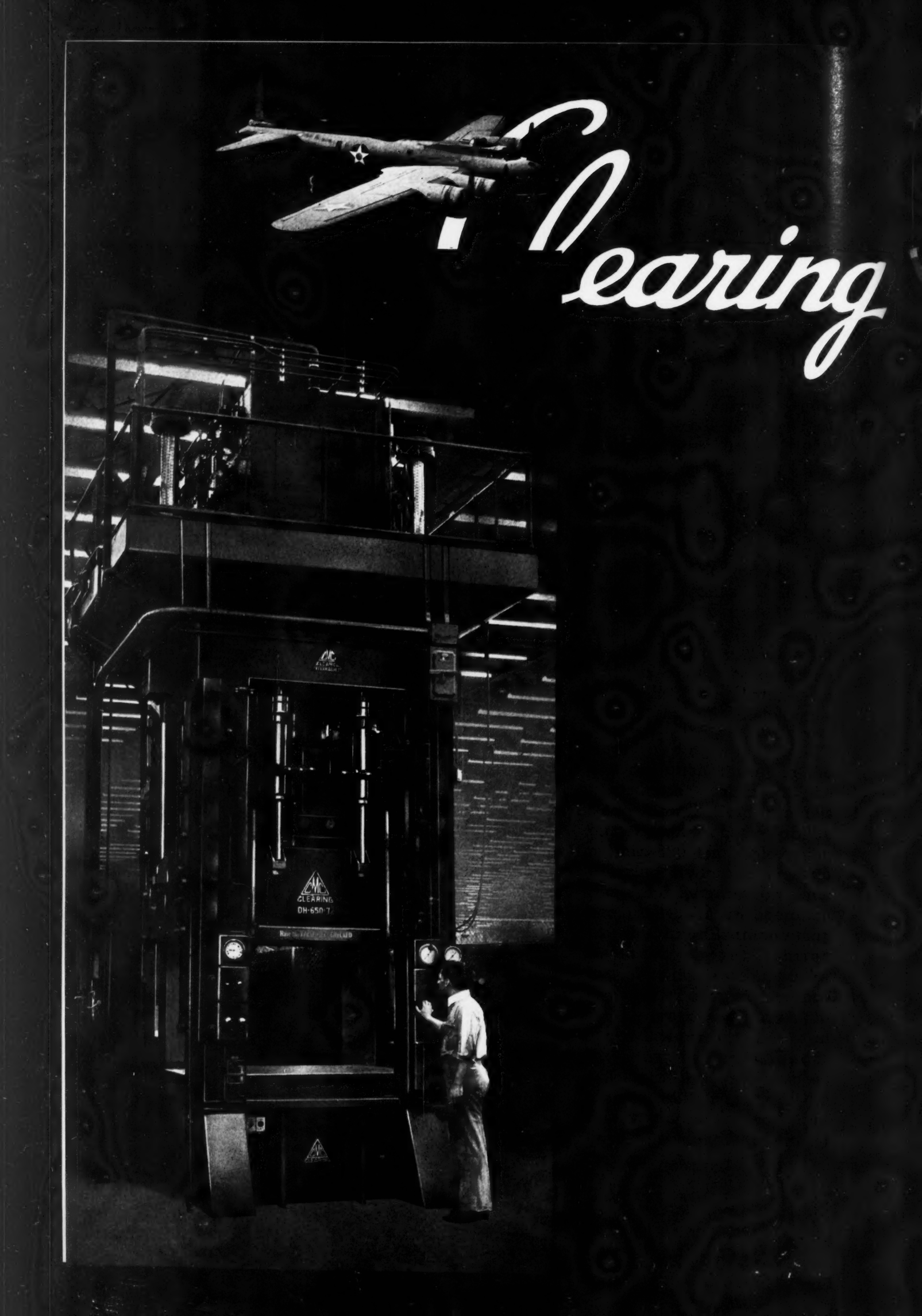


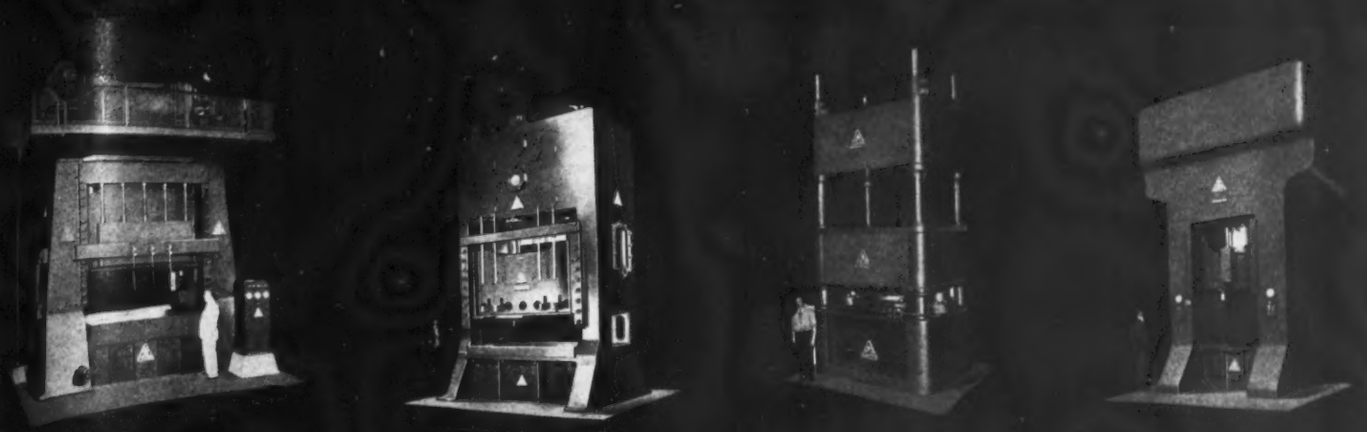
HYDRAULIC WORK TABLE TRAVERSAL WITH STEPLESS SPEED RANGE



RAPID ELECTRIC WHEEL FEED

390


Clearing
CLEARING
DH-650-T



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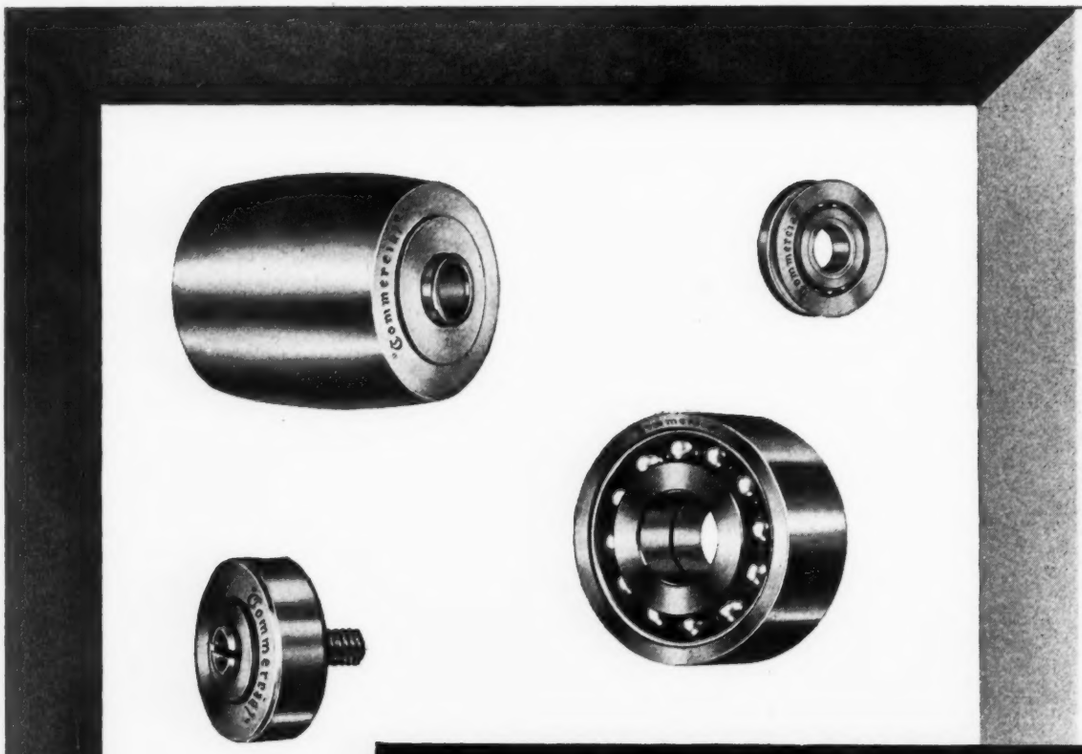

"Commercial" ANNULAR BALL BEARINGS

BALL BEARINGS FOR EVERY PURPOSE

"Commercial" Annular Ball Bearings are available in nearly all standard types and sizes. We also manufacture SPECIAL types of bearings designed for particular purposes—to meet your own needs and specifications. On this page, we illustrate special **"Commercial"** bearings used in various products. For instance:

BALL BEARING ROLLERS FOR TYPEWRITERS.
BALL BEARINGS FOR STRAIGHT EDGE CABLES.
BALL BEARING ROLLERS FOR OVERHEAD TROLLEY CONVEYORS.
TAPE ROLLER OR PULLEY FOR PAPER FOLDING MACHINES.

This gives some idea of the wide variety of bearings manufactured by us. All "Commercial" Bearings are precision built, accurate, tough and provide efficient, satisfactory service under all conditions.

Whether you need a few, or a great many units, our Engineering Staff will be pleased to assist in solving your ball bearing problems. Send for complete information and latest catalog.

THE SCHATZ MANUFACTURING CO.
POUGHKEEPSIE, N. Y.

Detroit Office: 2640 Book Tower • Chicago Office: 902 S. Wabash Ave.
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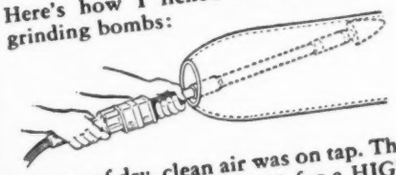
"AMERICAN"
FOR
ALL-OUT
PRODUCTION
"AMERICAN" PACEMAKERS
For AIRCRAFT PRECISION
On the hundred and one precision lathe jobs required in Aircraft Production, "American" Pacemaker Lathes are right out in front giving abundantly of what it takes to produce the world's finest aircraft on a 24-hour schedule.
"American" accuracy, "American" stamina, and "American" operating ease are the triumvirate insuring "American" Pacemaker leadership in vital war production.
THE AMERICAN TOOL WORKS CO.
CINCINNATI, OHIO
U.S.A.
Lathes—Radials
Shapers
"AMERICAN" Pacemaker LATHES

STANDARD
Dial Bore Gages
"CONVOY
YOUR PARTS
THRU
PRODUCTION"
STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK

WAR WINNER'S REPORT TO: Uncle Sam

Here's how I licked the problem of grinding bombs:



Plenty of dry, clean air was on tap. They didn't have to spend $832 for a HIGH-CYCLE converter.

Gave them a 26" extension grinder to reach inside the bombs (see sketch). This was 5 lbs. lighter on a power-for-power basis than my HIGH-CYCLE opponent.

Since the job required a lot of in-and-out handling, my lighter weight and simplified build got the decision to turn out the bombs faster.

AIR O'TOOL

(Winner, Round 8, Bout of the O'TOOLS)

"AIR" *helps us get at* TOKYO

Here, Rotor Air Grinders licked a problem of getting at the burrs inside bombs—to help U. S. bombers get at the Tojos inside Tokyo.

To make sure this grinding job would be done as thoroughly as the bombing job to come, the Rotor Analyst let AIR and HIGH-CYCLE decide which could turn 'em out fastest. Guesswork is out when the O'Tools have it out!

AIR won this Round 8. See his report.

Are you getting the kind of results from portable tools that can whip the Axis? Call in the unbiased Rotor Analyst to blast away the obstacles.

KEEP 'EM RUNNING! Get your free copies of the booklet and wall chart on maintenance of portable tools.

QUALITY

FEDERAL
BEARINGS

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

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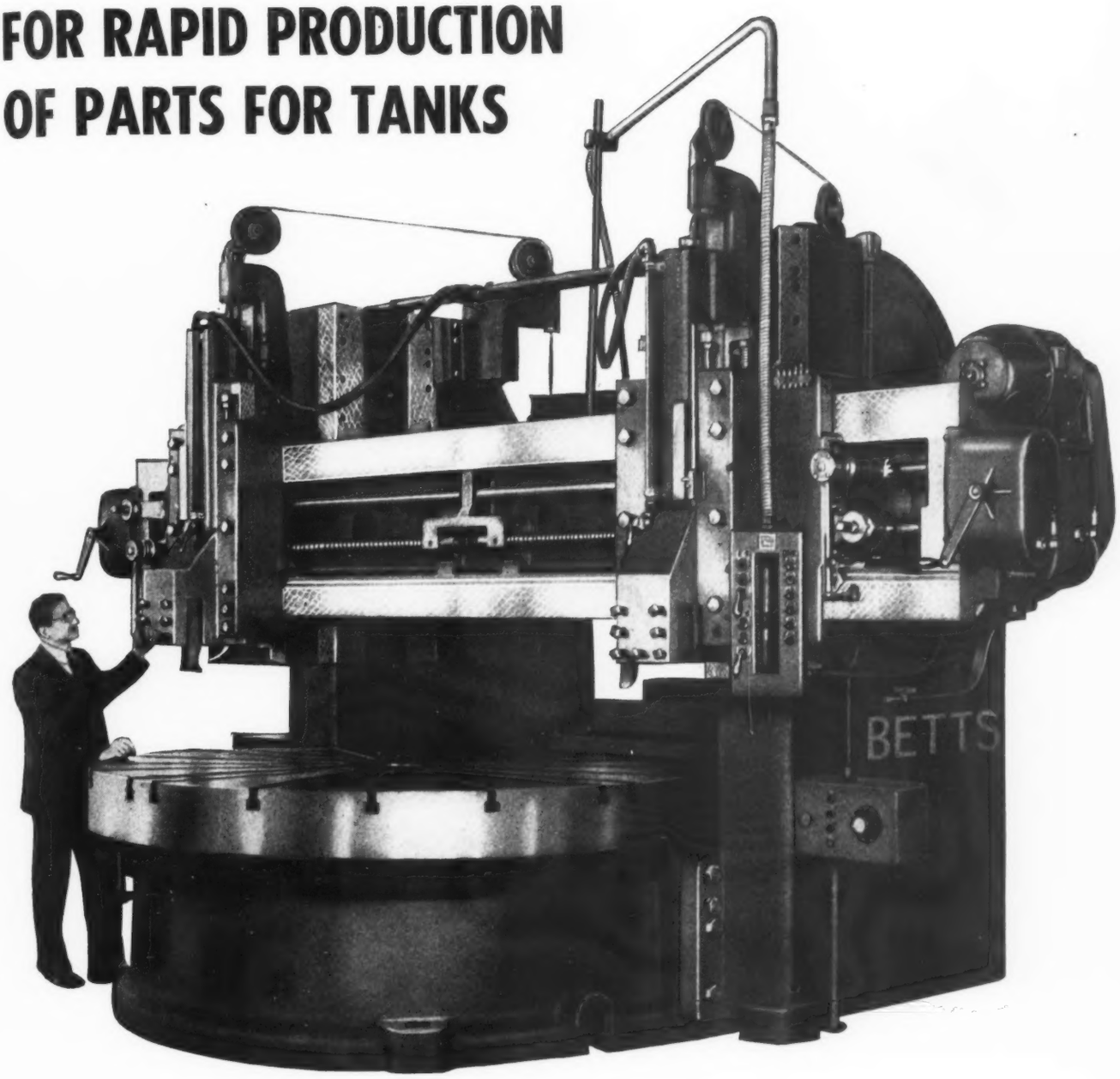
Chicago Office: 902 S. Wabash Ave. • Los Angeles Office: 5410 Wilshire Blvd.

BETTS TANK MILLS

FOR RAPID PRODUCTION OF PARTS FOR TANKS



The machine shown above is known as a 100" Tank Mill. It is so named because it was planned for the mass production of parts for tanks. In designing this machine there were two principal factors involved, first — a construction which would permit building the machines on a quantity basis, thus permitting quick deliveries; and second — a construction insuring the utmost in productiveness of parts for tanks.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

Designed for the

VICTORY PROGRAM

by the

HANCHETT

Manufacturing Company

Big Rapids, Mich.

Known from coast to coast for their efficiencies, HANCHETT No. 36 Vertical Spindle Rotary Surface Grinders are extensively applied to speed-roughing and precision-finishing operations on countless parts for America's Victory Program. An illustration of a typical application of this machine, in the tool room of the Davis Tool and Engineering Company, appears below. The set-up calls for both roughing and finishing tough steel parts, a job for which the No. 36 is ideally suited with its rotary magnetic chuck—its infinite range of speeds — its easy reading, centralized controls — its generously spaced dial feed graduations for .0001" — its all 'round ease-of-handling — its accuracy which can be held within .0003" at high rates of speed. Full information and literature upon request.

Tanks are Forgings

Tough, stress resistant forgings — parts that must withstand the most grueling punishment and service abuse — are essential in large quantities for the light, medium and heavy tanks now in production.

Because of the wider use of forgings, American-made tanks excel. They are faster, superior fighters, better able to withstand and "dish-out" blitz warfare.

Beating plow-shares into swords, making forgings for tank transmissions, engines, crawlers, guns and other operating parts is our daily job.

Ever more rough and finished parts of this type flow from under our hammers as the tempo of war production in our shops increases.

While our facilities today are heavily taxed, we still have the desire and the ability to serve more builders of tanks, ships, planes, guns, machine tools and ordnance.

A quick termination of totalitarian ambitions will speed the day when free men can follow normal pursuits. We are doing our part to help speed that day.

Proudly we fly the Navy "E" flag awarded for excellence and proficiency in the production of Naval Materiel.

KROPP FORGE COMPANY

Makers of Drop, Upset and Hammer Forgings for Guns, Planes, Tanks, Ships, Ordnance and Machine Tools

"World's Largest Job Forging Shop"

5301 W. ROOSEVELT ROAD, CHICAGO, ILL.

Representatives in Principal Cities

SERVING INDUSTRY SINCE 18 37 OVER 100 YEARS

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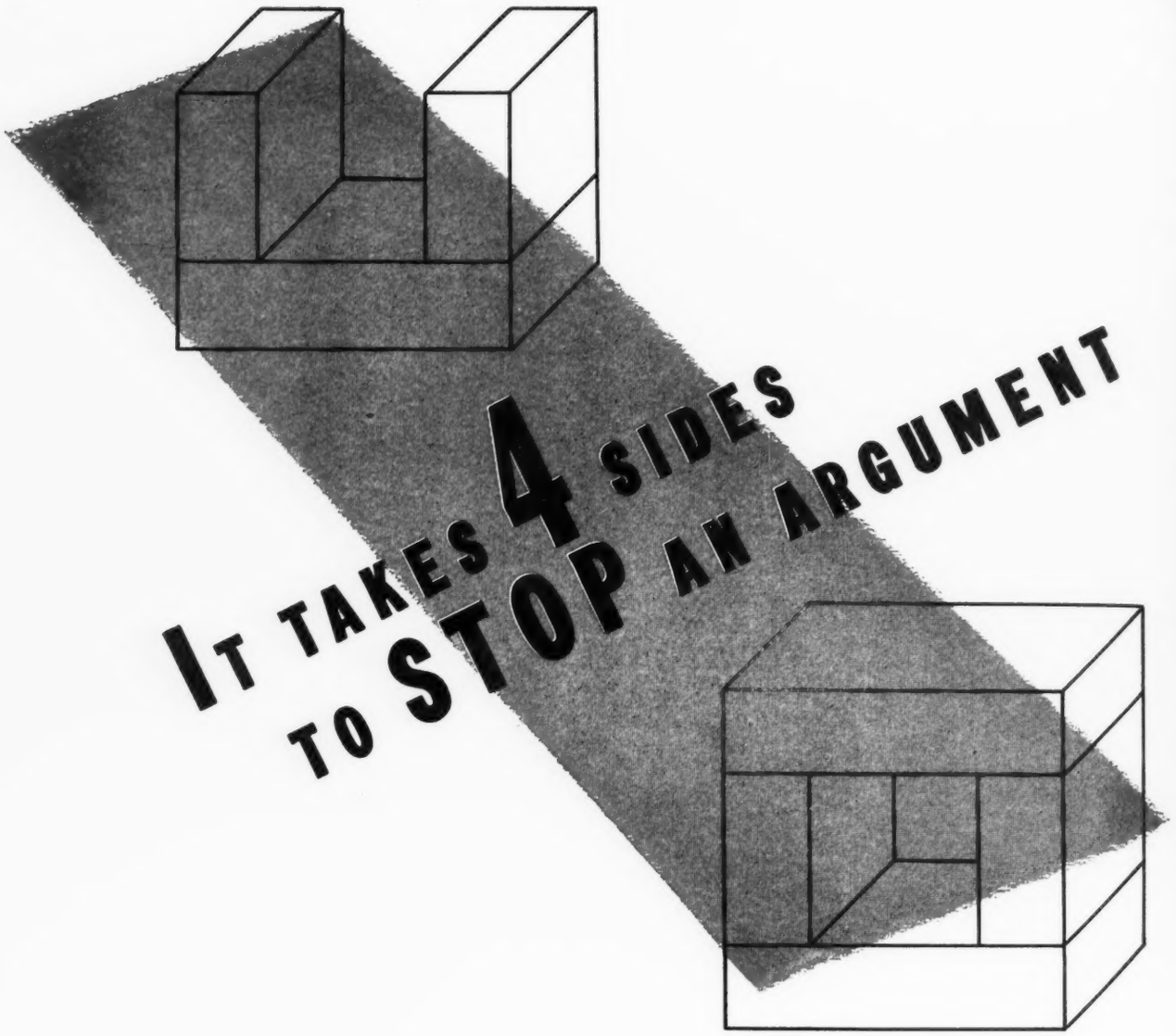
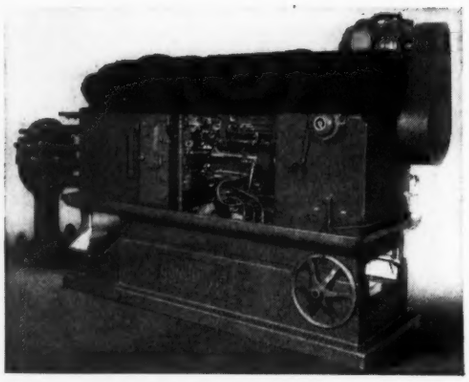
KROPP FORGE CO.

KROPP



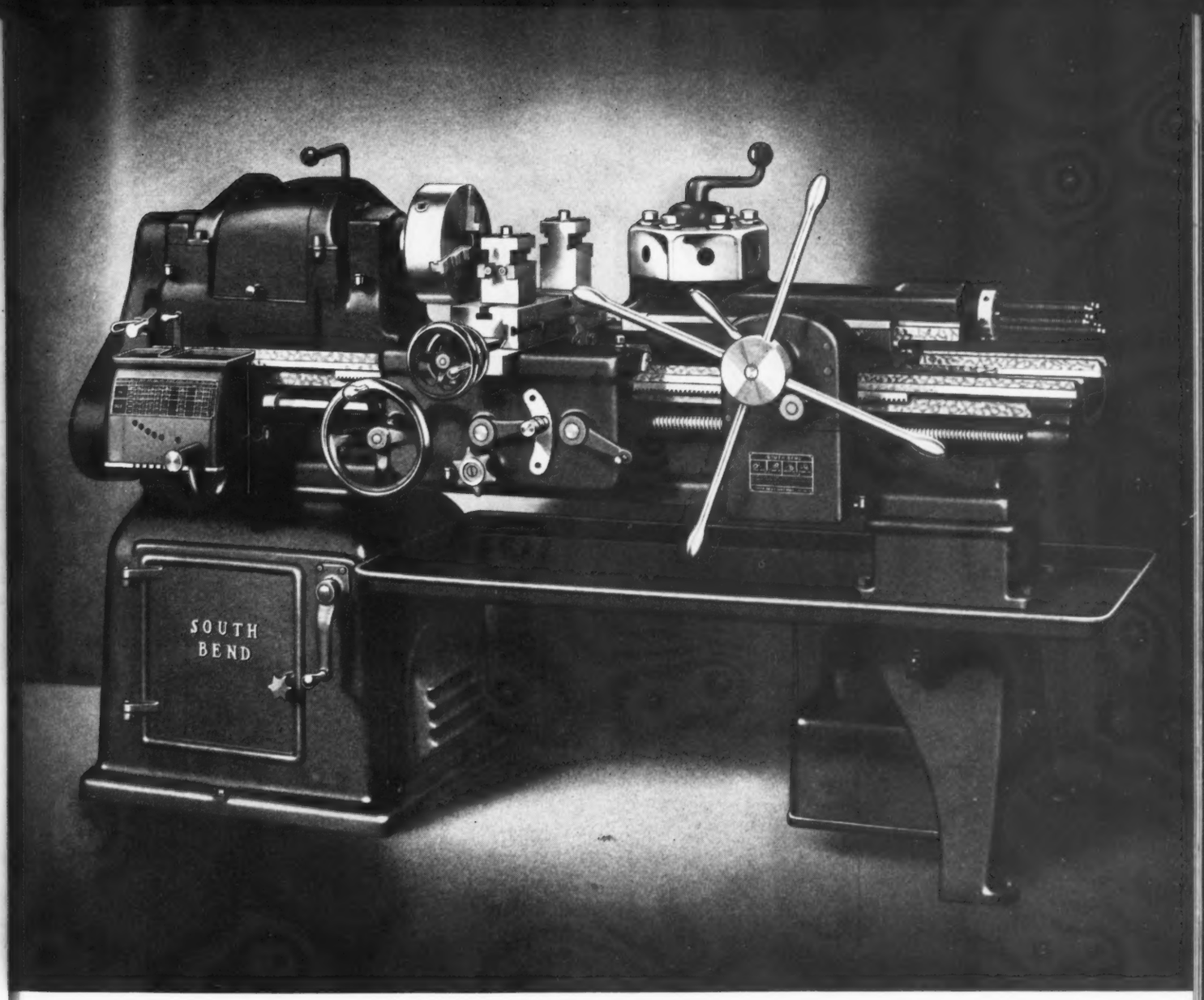


The red portion highlights an outstanding feature of Conomatic design —the cam shaft in the rugged top bed.

It takes four sides to stop the argument concerning accuracy and rigidity of multiple-spindle automatics.

Conomatic design includes a heavy, rugged top bed that completes the all 'round support of the work area — *four sides of* heavy, rugged support for accuracy, rigidity and durability.

All Conomatics are readily identified by the overhead cam shaft in the top bed. This construction has a triple advantage — it strengthens the mounting of spindles, auxiliaries, slides and tools — it puts the cams overhead away from coolant, dirt and chips — it affords easy accessibility, resulting in quick changeovers.



SOUTH BEND TURRET LATHES

For Efficient Production of Duplicate Parts

THE No. 2H South Bend Turret Lathe is a dependable tool for the efficient production of duplicate parts. It has the precision for exacting, close-tolerance operations, ample power, and the rigidity required for producing a fine finish.

Twelve spindle speeds, ranging from 16 to 880 R.P.M. are available. A two-speed motor with convenient lever control permits quick change from high to low speed for reaming and tapping operations. Smooth operation for precision turning and boring operations at high speed is achieved by direct belt drive to the spindle. Slow speeds for heavy cuts on large diameters are driven through back gears.

Bar work up to 1" round may be passed through the collet. The spindle hole has a capacity for stock up to 1⅜" in diameter when a universal chuck is used. Maximum capacity for chucking operations is 6⅞" swing over the universal saddle cross slide and 16¼" swing over the bed ways.

The ram-type turret has power feed and hand feed, with individual adjustable feed trip and stop for each of the six turret faces. The turret head indexes automatically on the return stroke of the turret slide.

The universal carriage has power cross feeds and power longitudinal feeds, also lead screw and splitnut feeds for cutting accurate screw threads. Plain cross slide fitted with front and back tool blocks is standard equipment. A 4-way turret tool block can be supplied to order. Write for a catalog and the name of our dealer located nearest you.

SOUTH BEND · LET'S GO! U.S.A. · KEEP 'EM FLYING!

SOUTH BEND LATHE WORKS

Dept. 777 SOUTH BEND, INDIANA, U. S. A.

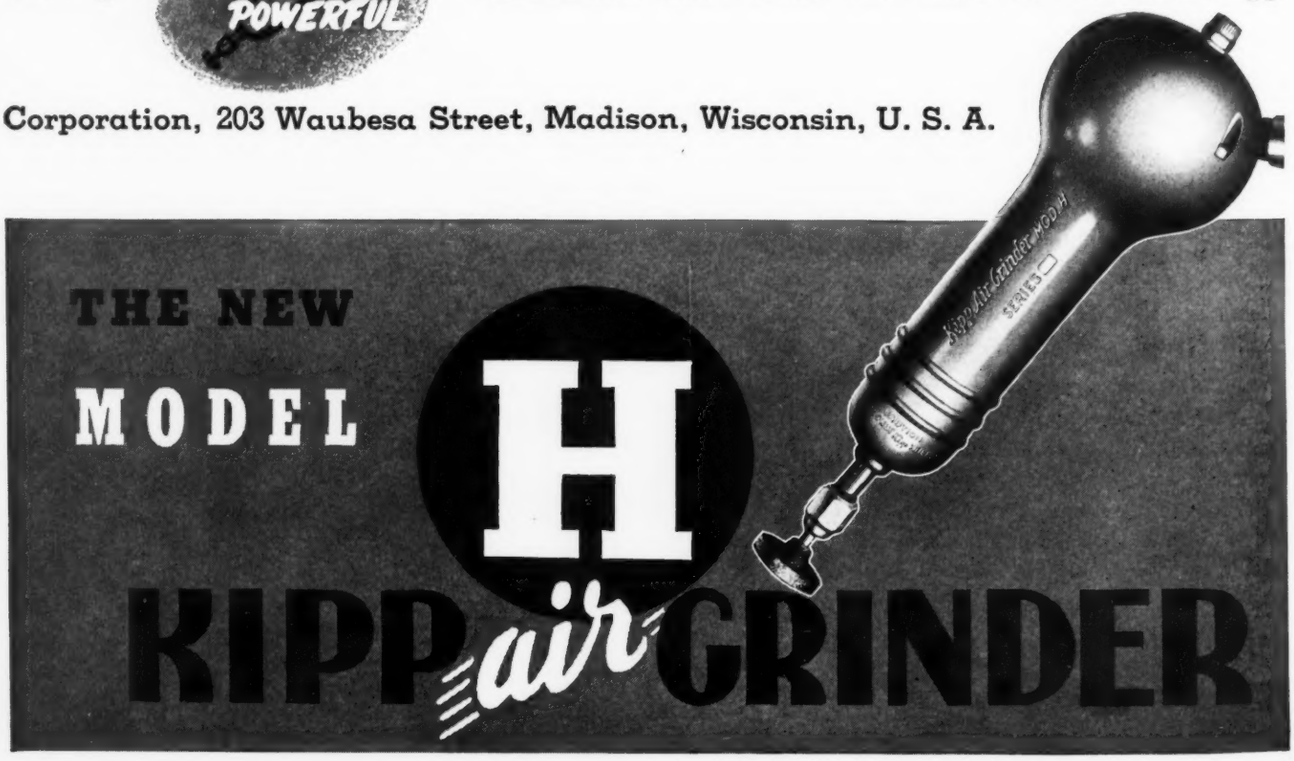
LATHE BUILDERS FOR 35 YEARS

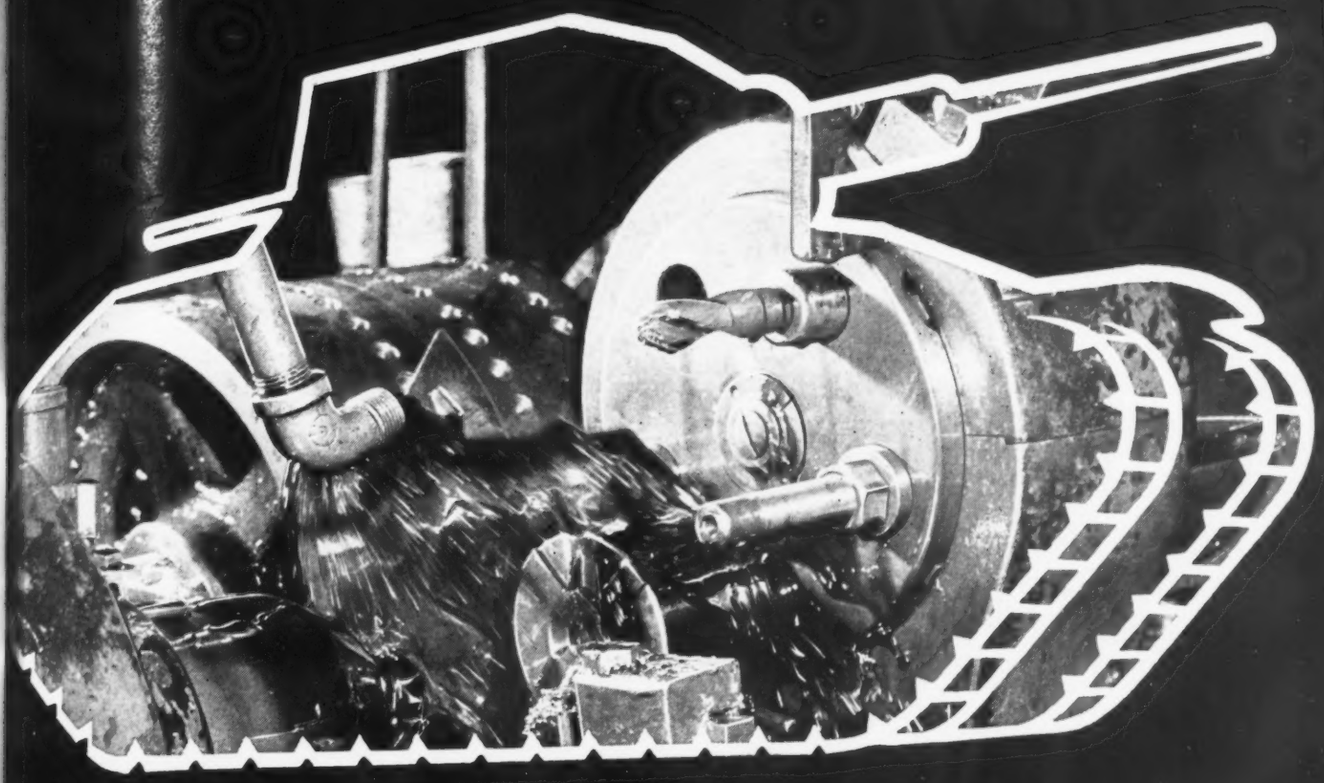
You'll Agree

WITH THOUSANDS OF OTHER

High Priority Producers

● They think the new Model H is the best all around off-hand tool they have ever tried and we are sure THE FAST you will agree with them. It's fast (50,000 R.P.M.), more powerful, has a handier grip. If you are doing priority work, order the new Model H Kipp Air Grinder today! Please attach THE HANDY preference rating THE POWERFUL certificate with order and mail to Madison-Kipp Corporation, 203 Waubesa Street, Madison, Wisconsin, U. S. A.





HOW TO SOLVE NEW CUTTING OIL PROBLEMS IN YOUR RETOOLING..FASTER

• How to get the speed, finish, and accuracy needed to meet production requirements? What cutting oils can help? You not only must have the answers—but you need them NOW!

New cutting oils and coolants are available, made to meet the problems you are facing. They have been tested and are in daily use by plants to do the same kinds of jobs you are handling.

Standard Oil Engineers have been working with many plants during retooling. They know what is needed to get high finish at high rates of speed. They know how to help you meet the close tolerances allowed. They have the combined experience of many plants, many jobs, working on new metals, with new tools. They are glad to share their knowledge with you, to help you do the job America asks you to do.

Ask a Standard Oil Engineer or metal-working specialist to help you. He probably can suggest a method or a product that will turn out your end of the job faster—better.

Call or write any Standard Oil Company (Indiana) office in the Middle West, or write 910 South Michigan Avenue, Chicago, Illinois.

Typical Cutting Oil Problems Standard Oil Engineers Have Helped Solve

JOB—Forming cartridge cases.
PROBLEM—Compound caused punch to "brass-up" and become oversize, requiring frequent changes.
RESULT—Stanostamp recommended. Eliminates brassing without excessive wear on punch. Job runs cooler and was speeded up 10%.

JOB—Form grinding threads on machine gun barrels.
PROBLEM—Speed up operation.
RESULT—Special compounded oil developed, permitting higher wheel speeds and feeds without burning work.

JOB—Machining tough aluminum alloy on airplane parts.
PROBLEM—Eliminate rough finish and rapid tool wear without use of lard oil.
RESULT—Developed special cutting oil that gave required finish and tool life with no odor development.

OIL IS AMMUNITION...USE IT WISELY

Copr. 1942, Standard Oil Company

STANDARD OIL COMPANY (INDIANA)

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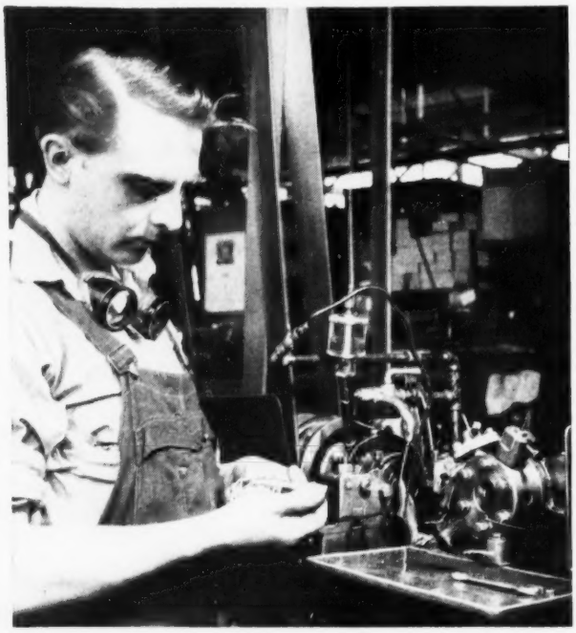
REPLACES PLANT-MIXED CUTTING OIL . . . SAVES TIME AND TOOLS

Here's an example of how Standard Engineers can help you cut corners on production time. An electrical equipment manufacturer used a base oil and paraffin oil mixed in the plant. Under normal operation, this cutting oil was satisfactory. But defense work speed changed the story. The mixture wasn't uniform. Tool life suffered. Even the time and labor required for mixing became important.

A Standard Oil Engineer recommended a tested refinery-blended cutting oil. Tool life jumped 300% with this



uniform product. Each batch of oil gives the same results.

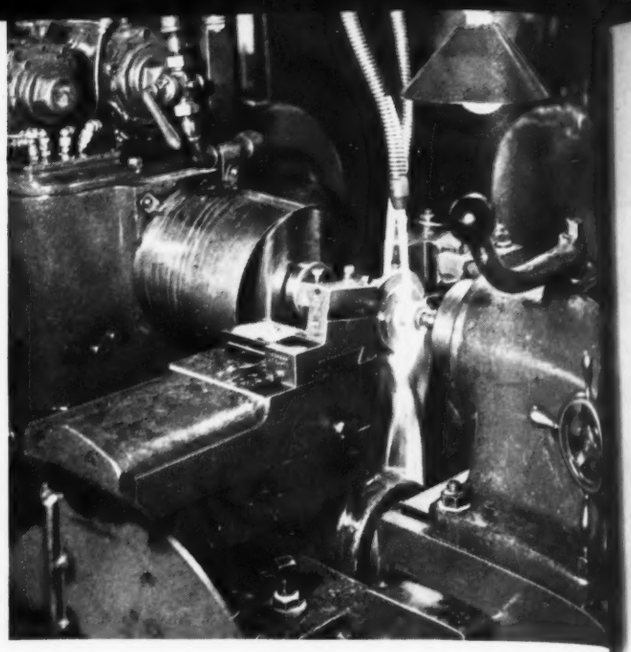
Your problem may be different, but the way to solve it is the same—get a Standard Oil Engineer's help.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Just phone any local Standard Oil Company (Indiana) office in the middle western states listed below, or 910 South Michigan Ave., Chicago, Illinois. In Nebraska, call or write Standard Oil Company of Nebraska at Omaha.

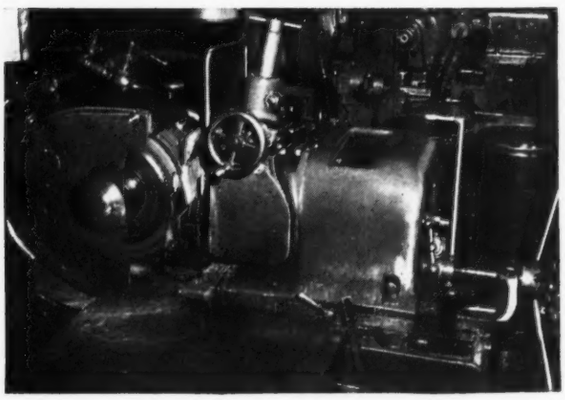
COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY



STOPS RUSTING OF PARTS... NO SEPARATION WITH SUPERLA SOLUBLE OIL

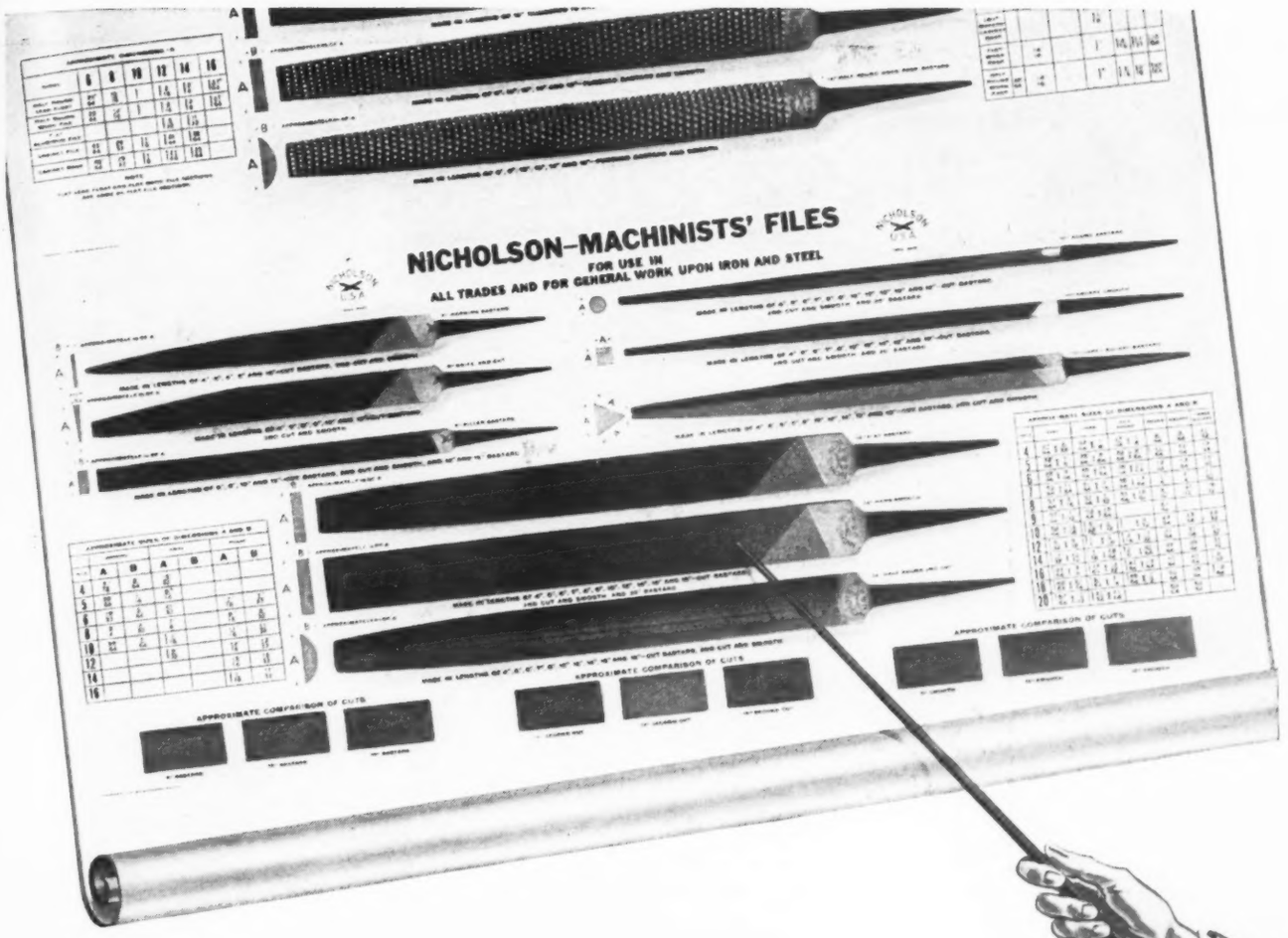
Today, time spent cleaning deposit-coated coolant lines or mixing balky coolant emulsions puts the brakes on war production. Try Superla Soluble Oil. It mixes easily, even with hard water, without any water softening agents. It doesn't separate and form deposits in tanks and coolant lines. Because the oil is dispersed evenly throughout the emulsion, a thin film of rust-preventing oil is left on the work. A Standard Oil Engineer can recommend the mixture you need for the best tool life and rust protection on your work.



KEEP OIL SYSTEMS CLEAN WITH INDOILS

Sludge formation, and clouding of sight feed oilers on a number of grinding machines in a Michigan war-goods plant is typical of the lubrication problems on which a Standard Oil Engineer can help you. Here, the Engineer recommended Indoil—it had eliminated this trouble in many plants—it did here. Machines now run for months without cleaning or changing oil.

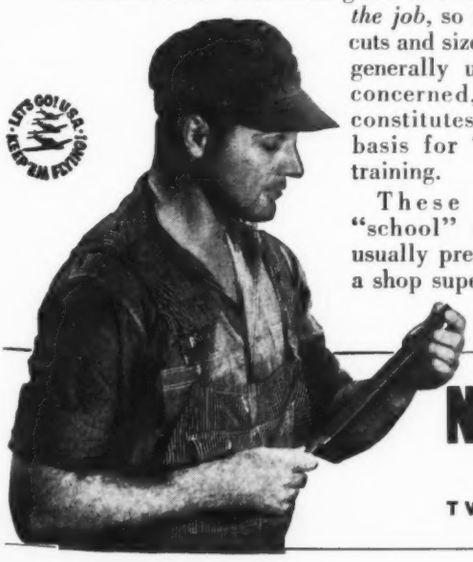
STANDARD OIL COMPANY (INDIANA



First Aid to Filing Efficiency

BESIDES making files of inherently high filing efficiency, Nicholson has developed numerous aids to enable machine-shop managements and workers to *bring out* that efficiency.

The Nicholson Wall Chart — portion of which is reproduced above — is one. In addition to serving as a convenient tool-room guide to *The right file for the job*, so far as shapes, cuts and sizes of the more generally used files are concerned, this Chart constitutes a valuable basis for "classroom" training.



These employee "school" sessions are usually presided over by a shop superintendent or foreman. And from their extensive studies of individual filing problems, Nicholson service engineers themselves have delivered educational talks before such groups.

Elementary literature on filing and technical bulletins on the features and uses of special purpose files are also available.

If you've a training auxiliary or program in which we can be of help with any of the aids indicated above, *write us about it.* For your file needs—and practical help on file purchases — contact your mill-supply house.

NICHOLSON FILE CO. • PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

SAVE MAN-HOURS through the proper use of files . . . through *The right file for the job* . . . and through the highest quality files made—Nicholson and Black Diamond.

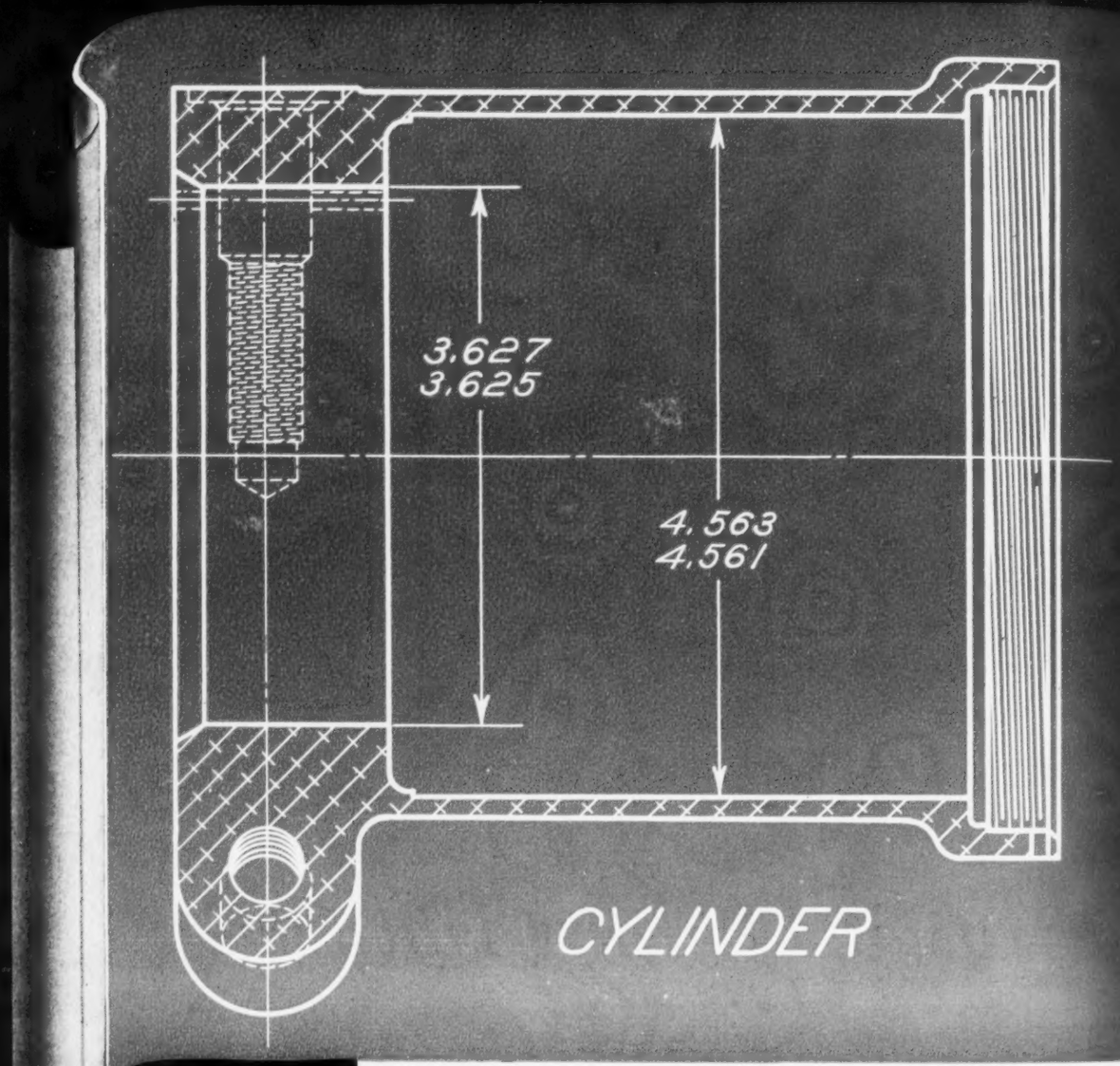
NICHOLSON FILES

FOR EVERY PURPOSE

TWELVE PERFECT FILES IN EVERY DOZEN

NICHOLSON U.S.A. MADE IN U.S.A.

POTTER & JOHNSTON A



BLUEPRINTS OF
Production

P&J

OTTER & JOHNSTON
IACHINE COMPANY
PAWTUCKET, RHODE ISLAND

P&J 5D POWER-FLEX *for creditable propeller operating*

Aluminum alloy forgings, from which the above illustrated variable pitch propeller operating cylinders are machined, are produced to close limits of accuracy, at low operating costs, at high output rates on the P&J 5D POWER-FLEX AUTOMATIC with P&J tooling. On this work one operator can easily handle a number of P&J Automatics. The close-up photograph clearly illustrates the tooling for finishing the hole; of special interest is the special form of slide tool on the rear cross slide arranged for taking a single point cut on the O.D. below the flange. Contributing to the efficiency of this

AUTOMATICS

OPERATIONS:

1 T. F.—ROUGH TURN, ROUGH FACE END, ROUGH FACE HEAD END ADJACENT TO BARREL DIA., ROUGH FORM RADII.

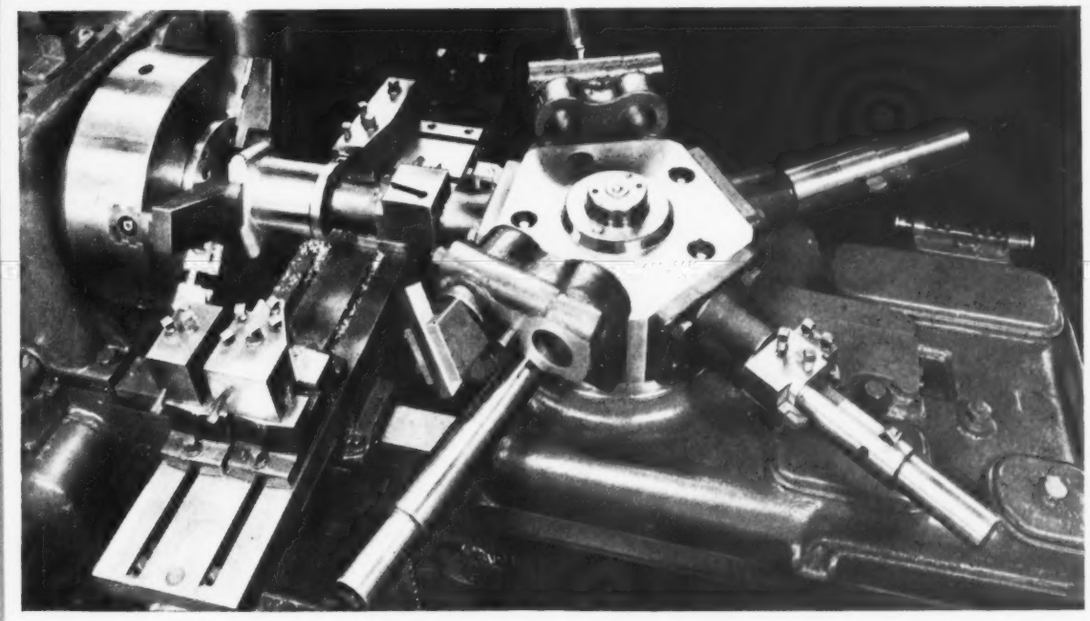
2 T. F.—ROUGH BORE AND FACE THREAD DIA., FORM RAD., ROUGH BORE THREE DIAS., TURN DIA.

3 T. F.—FINISH BORE AND FACE DIAS., FINISH BORES, FINISH FACE END, CHAMFER WHERE NECESSARY.

4 T. F.—REAM TWO BORES.

5 T. F.—FINISH THREE RADII ON THE BORE.

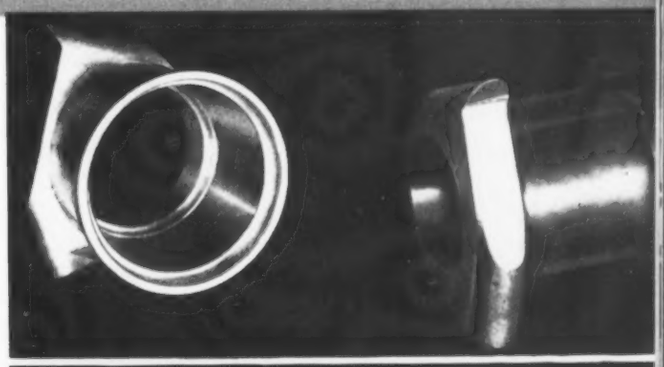
ONE OPERATOR EFFICIENTLY HANDLES A NUMBER OF THESE P&J AUTOMATICS.

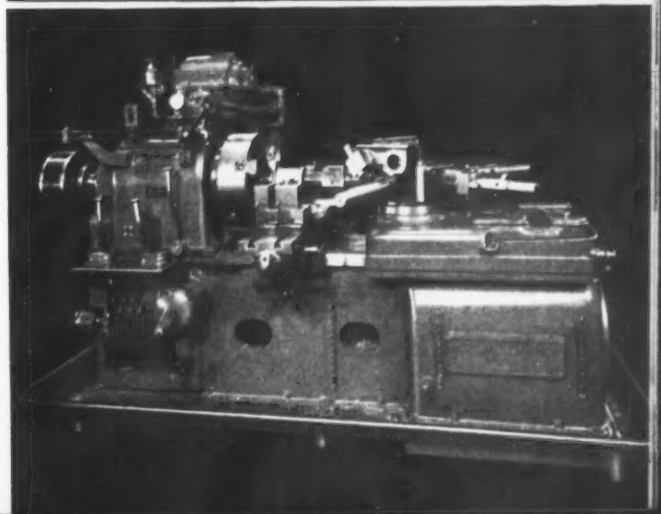


FLEX AUTOMATIC

Performance on Aircraft Cylinders . . .

important aircraft production operation are the P & J features of the 5D POWER-FLEX AUTOMATIC which include a self contained headstock with four automatic speed changes, three automatic feed changes for cross slide and turret slide, turret indexed by Geneva movement with automatic binder clamps, cross slide which operates with action of turret tools. If desired, an auxiliary slide tool may be mounted on the turret. Cross slide can act as operating mechanism. Timken tapered roller bearings on headstock spindle and shafts.





For Mass Production of Aircraft Parts

. . . install Baldwin Southwark Hydraulic Presses

Helping the aircraft industry "get 'em in the air" Baldwin Southwark hyspeed hydraulic presses feed a steady supply of parts to the assembly floor. Southwark hydraulic presses maintain high production rates and prolong the life of the dies. Die set-up and changing time have been sharply reduced. Delays caused by breakage of dies and press members are gone. Pressed pieces hold their shape—spring-back is out.

Southwark has built scores of presses ranging from 100- to 5,500-ton capacity that have taken their places on aircraft production lines. Southwark hyspeed hydraulic presses can help you do a better job—faster. Write today for our Bulletin K-160.

Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

BALDWIN

Southwark

BLW THE BALDWIN GROUP

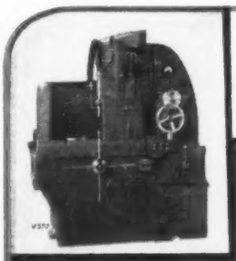
DIVISION OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

"PUT IT ON THE BLANCHARD"

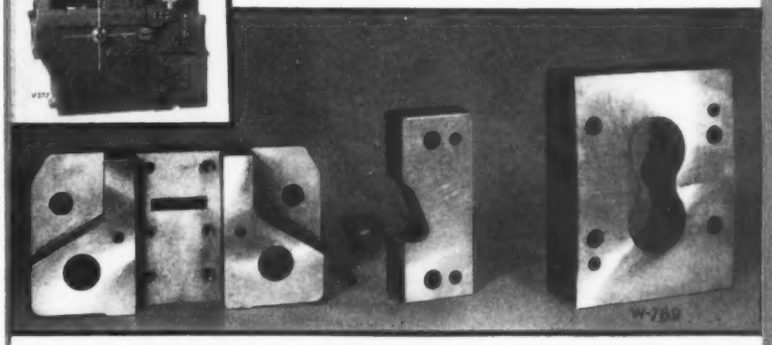
CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- ★ **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- ★ **Fine Finish**
- ★ **Flatness**
- **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Dies sharpened on the Blanchard No. 11 last longer — save you money



Tool makers - Die makers GRIND DIE JOBS LIKE THESE ON THE BLANCHARD No. 11

The cylinder wheel covers the entire surface at every revolution of the work. High work speed and ample supply of coolant eliminate any danger of heating the work. The Blanchard is a heavy and rigid machine, permitting the economical use of free, soft cutting wheels.

"Excellent — Fast — Accurate" says this customer after more than a year of tool room use.

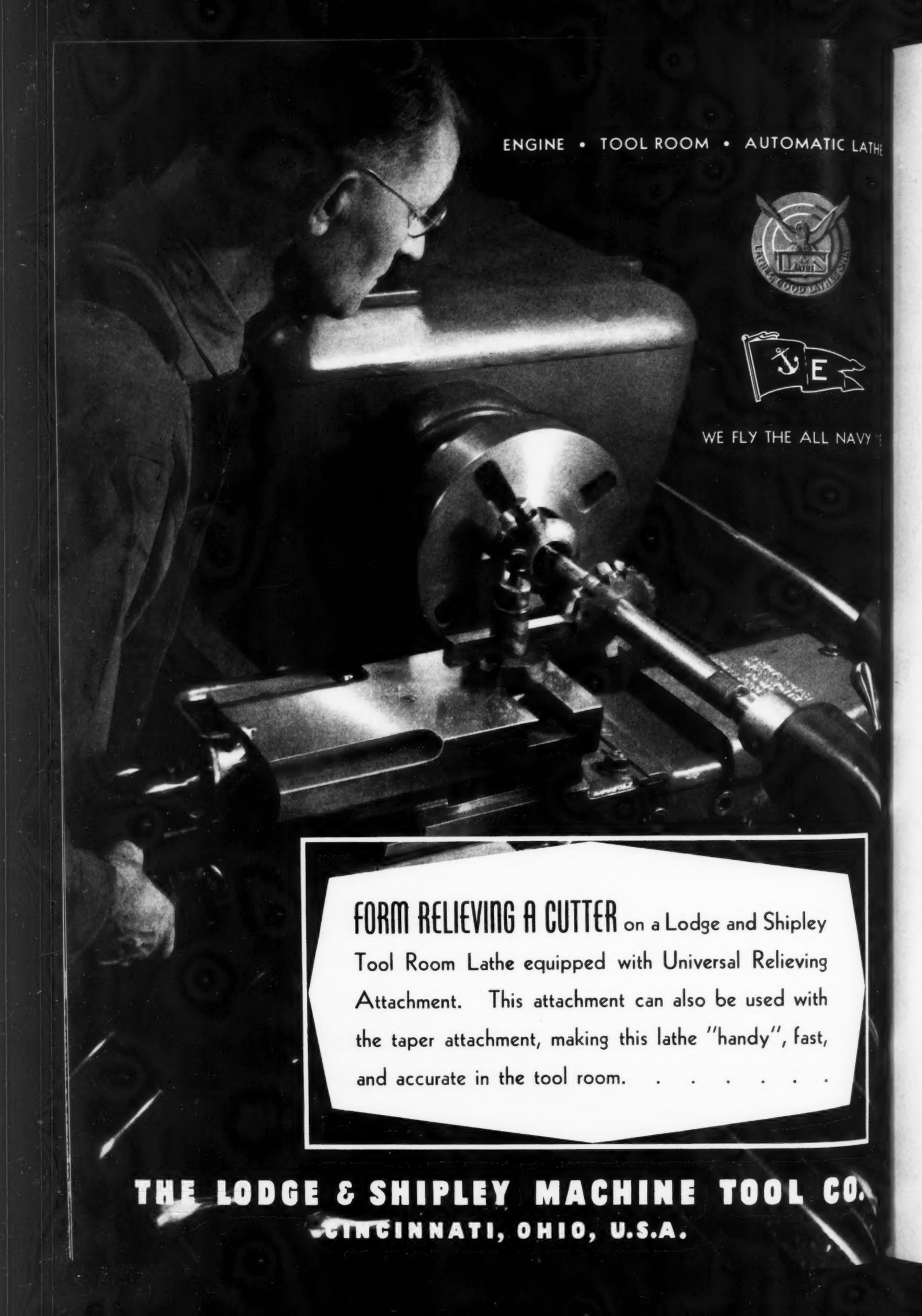
Savings in time and money, and opportunities to release men from grinding to other work, make it logical to install Blanchard Grinders in every tool and die shop.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



FORM RELIEVING A CUTTER on a Lodge and Shipley Tool Room Lathe equipped with Universal Relieving Attachment. This attachment can also be used with the taper attachment, making this lathe "handy", fast, and accurate in the tool room. . . . . .

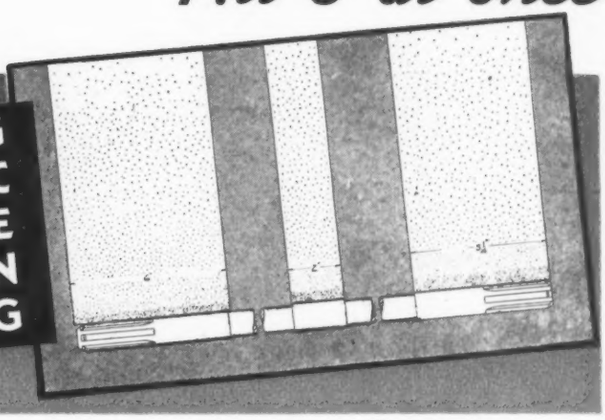
THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A.

WAR TIME GRINDING DEMANDS

All 3 at once

FITCHBURG AUTOMATIC MULTIPLE PRECISION GRINDING



Similar in principle to multiple tooling — automatic in operation — cuts costs in your mass production work.

In recent years multiple tooling and combined cutting have made important new savings possible on machine tool work. Today the same principles are being applied by Fitchburg engineers to cut costs by multiple precision grinding on mass production work.

By grinding several dimensions automatically on the same piece at one mounting, the operator is released for other work, the total of all operations is condensed within the time of the longest single grinding operation, and one handling replaces a succession of handlings — with a consequent saving in time and reduced danger of spoilage.

Fitchburg special mass production grinders utilize self-contained standard Bowgage Wheelhead units — easily adaptable to other work if operations change or discontinue.

In speeding the production of weapon barrels, shafts, long spindles, etc., keep your investment in special grinding equipment at a minimum, let Fitchburg engineers study your blue prints.

This Book shows how to cut grinding costs. . . . Free to executives. . . . Write for it today.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

INDUSTRY SHOOTS PRODUCTION MINUTES

MICROHONING MAKES MORE HITS

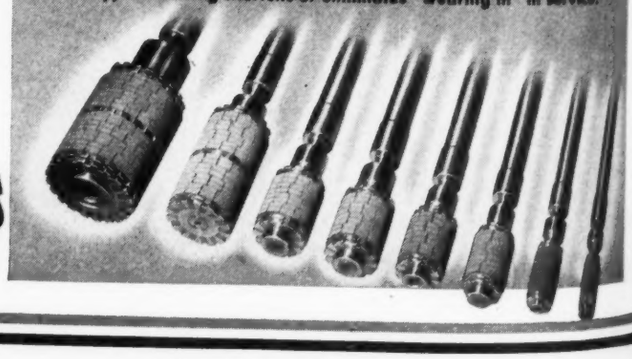
SAVE TIME
★
SAVE METAL
★
SAVE COST
★
IMPROVE QUALITY
★
WITH MICROHONING

DIESEL•••—

24" Microhone for Diesel engine liners. Extra miles per hour in submarines, mine sweepers and similar marine engines require the controlled accuracy provided by Microhoning.

ORDNANCE•••—

Draw Finish Microhones. These provide a finish in recoil chamber and other bores with all machining marks co-directional with the axis of the bore. Simulating a mechanical wearing in process—this type of honing shortens or eliminates "wearing in" in service.



ORDNANCE•••—
Large Microhones for gun barrels.

Micromatic Hones have lowered the time required for final sizing and surface finishing operations from days and hours to minutes and seconds.

Microhoning saves TIME COST—METAL REMOVAL—MANUFACTURING COST—AND IMPROVES PRODUCT QUALITY; which, combined, means more target hits in the tough service of WAR.

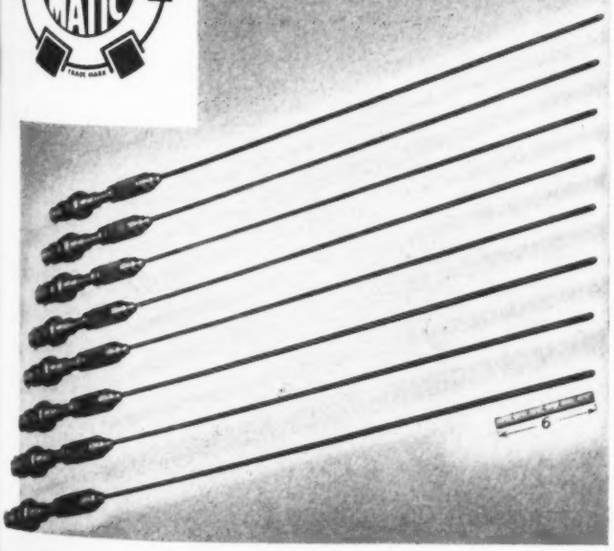
Micromatic Hones range from sizes for bores .303" to 25½" in diameter—from ¼" to 900" long. They generate geometrical and dimensional accuracy, uniform size and any desired surface finish with minimum removal of stock.

MICROMATIC HONE CORPORATION
1345 E. MILWAUKEE AVE. • • • DETROIT, MICH

ORDNANCE•••—

MICRO MATIC

ORDNANCE•••—
Rifle barrel Microhones for .303" bore have speeded and improved precision rifle making throughout the allied nations.



DIESEL•••—

The use of Microhoning is expanding rapidly. Let us send you literature on latest developments.

Heald Service Starts Here

Shown above is one aisle of many in our fireproof vault where invaluable engineering records are filed.

Some idea of our engineering capacity and production can be obtained from the Printing Department where on an average every day in the year 4300 square feet of blueprints roll out from the Pease No. 22, while the Ozalid Black & White machine produces 4650 square feet every 24 hours.

The 250,000 drawings carefully filed in Heald vaults represent a tremendous amount of engineering knowledge accumulated through many years in serving industry in precision finishing. Found in these drawings is a quick answer to all kinds of problems in precision grinding and boring . . . in the wealth of machine design developed to meet ever-changing finishing requirements . . . in the special machine details that have solved countless special problems . . . in the hundreds of fixtures designed for quicker and more efficient chucking . . . in the infinite variety of tool applications. Today, this backlog of engineering data has become a source of service tremendously valuable in keeping production rolling . . . for these 250,000 drawings as interpreted by 250 Heald Engineers form an encyclopedia of production know-how immediately available for helping all our customers solve every kind of problem involving precision internal grinding, surface grinding and precision boring.

THE HEALD MACHINE CO. *WORCESTER, MASS. U. S. A.*

SPEEDY TOCCO

cuts hardening costs from 16¢ to 1¢ per pin

● Today, the battle-cry of production is SPEED. Tomorrow, in the Battle for Business, it will be ECONOMY.

Why not get both, now, with TOCCO Induction Heat-Treating?

As for *speed:* TOCCO users report increases in output of as much as 600%.

And here is a typical report on TOCCO *economy:* Marmon-Herrington Co., Inc., Indianapolis, Ind., is hardening tractor track pins at a rate of 200 per hour at a cost of 1¢ per pin. Formerly pack-hardened at a cost of 16¢ per pin. TOCCO Jr., in assembly line, minimizes haulage. No sand-blasting required. TOCCO machine is always "on the alert," ready for instant hardening of any quantity of pins. Also, strength and life of TOCCO-hardened pins are greater.

Find out how TOCCO can give *you* increased SPEED, ECONOMY and QUALITY for hardening or heating operations.

THE OHIO CRANKSHAFT COMPANY
CLEVELAND, OHIO

SPEEDY ELECTRIC HEAT IS GENERATED WITHIN THE SECTION TO BE HEAT-TREATED

TOCCO

World's Fastest, Most Accurate Heat-Treating Process

FIRTHITE

T-04

TUNGSTEN-TITANIUM CARBIDE

THE NEAREST APPROACH IN TOUGHNESS AND STRENGTH TO HIGH SPEED STEEL YET DEVELOPED IN A CARBIDE

EASY TO GRIND—Firthite T-04 will take a keen, smooth edge and can be ground to steep rakes and clearances with deep chip-curling grooves.

UNIQUE—Firthite "GRADE T-04" Tungsten-**Titanium** Carbide is a **Firth-Sterling** development—the result of years of research. It sets new performance standards. T-04 is especially recommended for heavy duty, interrupted cuts, coarse feeds, etc.

UNIVERSAL IN APPLICATION—Firthite T-04 is the closest known approach to a **universal grade** of carbide. It approximates high-speed steel in **toughness** and **strength.** Production records show that T-04 gives uniformly fine performance in such varied applications as cutting armor plate, roughing softer steels, machining both cast iron and chilled cast iron—also other metals.

WILL STAND ABUSE—Firthite T-04 is tough, strong, wear-resistant. It withstands abuse from intermittent cuts, old machines, excessive overhang, inexpert operators, etc.

GOOD FOR INEXPERIENCED TRAINEES—Because Firthite T-04 does not require extra care in operation, it is the logical choice for training new operators in the use of sintered carbides. It is also ideal for any new application.

CONTAINS TITANIUM—The **Titanium** ingredient in T-04's composition plays a triple role: (1) converts an otherwise ordinary tungsten-carbide grade into a star performer in cutting steel; (2) lowers the price to you; (3) precludes any possible shortage, since **Titanium** is the ninth most plentiful mineral and the domestic supply is more than ample for ALL requirements.

WHATEVER you are machining, use FIRTHITE. It's aces! Besides T-04, other grades of Firthite Tungsten-**Titanium** Carbide are available and will likewise SAVE YOU MONEY. They cover the entire field of Steel Cutting with maximum efficiency. **GRADE TA** is for general use on certain steels. **GRADE T-16** is for light, rapid finishing of harder steels.

REMEMBER—a pound of Tungsten used in FIRTHITE does many, many times the work of a pound of Tungsten used in high-speed steel.

TOOL STEELS AND CARBIDES FOR COMPLETE SHOP TOOLING

Firth-Sterling

STEEL COMPANY

OFFICES: McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

YOUR BEST BET

FOR

Send
Send in the
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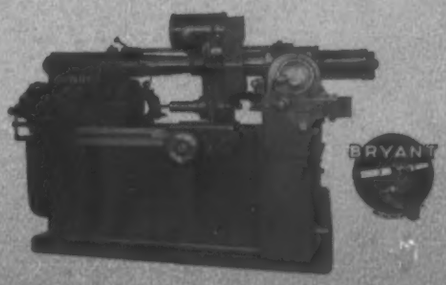
Send in the m
Bryant
Bryant
the man from

Send in the man from Bryant

If any operation, on any product you make, involves internal grinding, it should pay to see the man from Bryant—to tell the man from Bryant all you can about it, to load him down with blueprints, data, specifications and facts in every available form.



Not only has Bryant stepped up production of modern internal grinding equipment (already tripled, and constantly increasing)—but Bryant engineering is also stepping ahead.

Not only does Bryant recognize the duty of American industry to go all-out for war production, but Bryant stands ready today to help far-sighted management to plan low cost production for peace time goods to sell in tomorrow's competitive markets.

So whether your problem is preparedness now or profits tomorrow, let us send in a man from Bryant.

Send in the man from Bryant

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

INSTALL ONE unit . . . DO 4 jobs

WITH WESTINGHOUSE COMBINATION LINESTARTERS for a-c motor circuits

Size 1 Combination Linestarter, Class 11-206

Westinghouse Nofuze Circuit Breaker

1 ACTS AS MANUAL DISCONNECT SWITCH. Locking arrangement permits padlocking cabinet closed and switch in off position. Eliminates need for separate switch. "De-ion" arc quenching protects contacts.

2 PROTECTS CIRCUIT AGAINST OVERLOADS. Bi-Metal gives positive protection against short circuits and severe overloads . . . does away with need for fuse equipment. Unvarying — factory-calibrated — self-indicating.

Westinghouse "De-ion" Linestarter

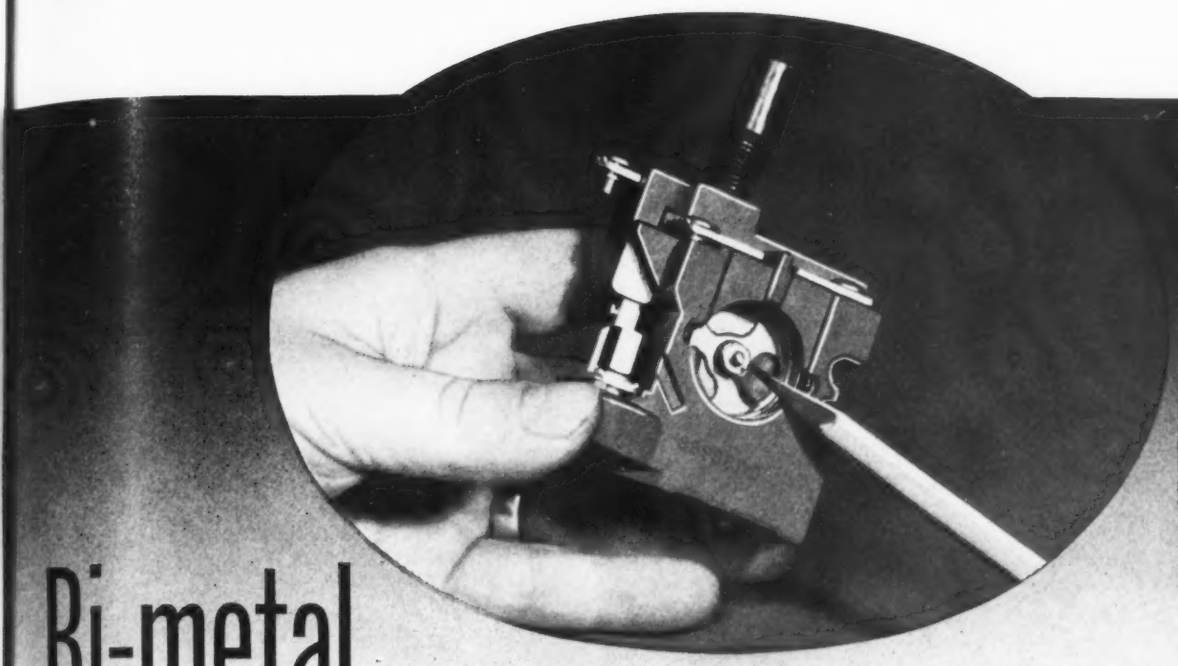
3 GIVES MAGNETIC ACROSS-THE-LINE STARTING. Permits operating motors by push button, float or pressure switch. Contacts opened and closed by direct-acting, vertical solenoid magnet. "De-ion" arc quenchers protect contacts.

4 PROTECTS MOTOR AGAINST OVERLOADS. Bi-Metal relay calibrated to protect motor permits momentary overloads as in starting, but protects motors from sustained overloads.

—save space! This single verything you need for the ne compact, easily installed

se Combination Linestarters com- dvantages of Nofuze Circuit Breakers e-ion" Linestarters. They eliminate delays fuse replacements, and simplify the job of providing proper control and protection for motor circuits. Specify them . . . install ONE unit—and do FOUR jobs! Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Westinghouse



Disc type Bi-metal protection as used in Westinghouse Motor Starters. Bi-metal disc is composed of two metals with different rates of expansion, bonded together. When heated by overload, the disc snaps, opening the circuit. Bi-metal protection is unvarying—has nothing to wear out or replace.

Bi-metal PROTECTION . . . A WESTINGHOUSE FEATURE

THAT MEANS ADDED PROTECTION FOR VITAL CIRCUITS

Motor or circuit protection that operates when it doesn't need to, means unnecessary production delays to replace fuses or restore service. Protection that is prevented from operating when it should, means even more expense in damaged motors or machines.

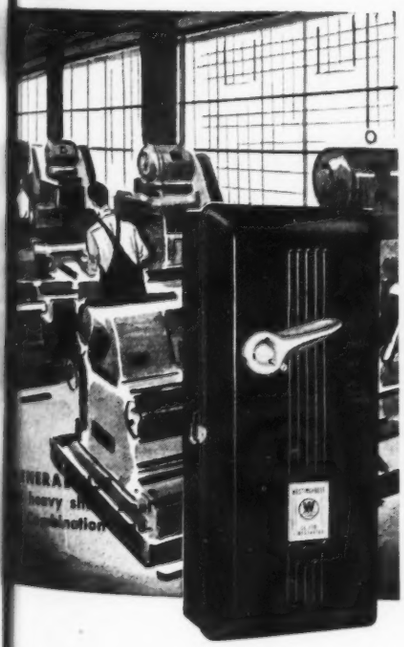
BI-METAL protection—a Westinghouse development—solves both problems. It acts with uncanny accuracy to permit temporary overloads, as when motors are started across the line, yet snaps the circuit open with rifle-bullet speed when short circuits or dangerous overloads occur. Factory-calibrated, it can't be tampered with or held closed against short circuits.

BI-METAL is a basic protective feature of Westinghouse motor starters and circuit breakers—you get it at no extra cost. Use it for the added, accurate protection it affords—specify Westinghouse protective and control equipment.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

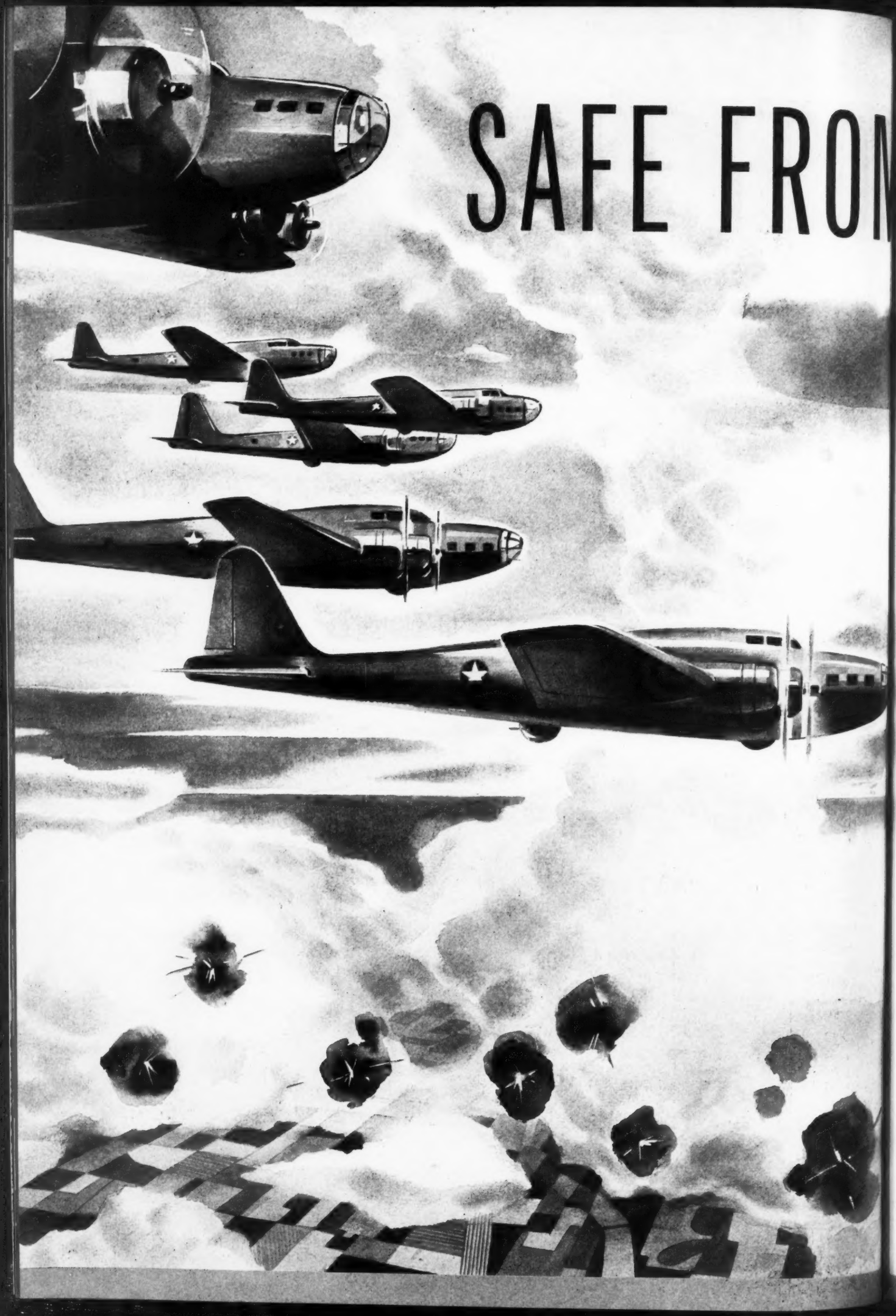
J-21186

"DE-ION" COMBINATION LINESTARTERS MEET JOB REQUIREMENTS



Motors and Control

WESTINGHOUSE


SAFE FRONT

...THE ACK-ACKS . .

but breathing sea-level air

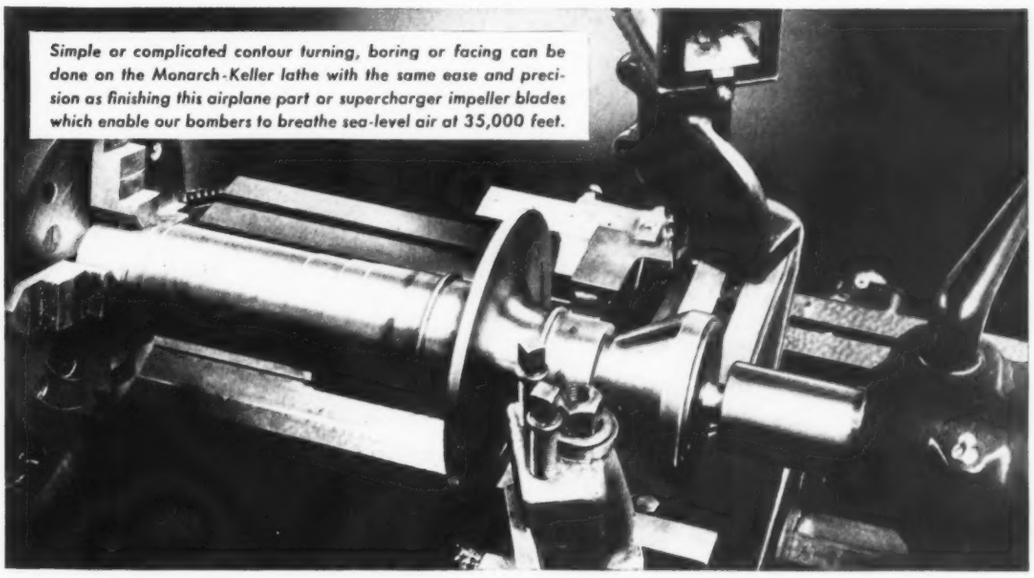
American bombers can maneuver at 35,000 feet—safely above effective anti-aircraft fire. But motor efficiency calls for dense air, so a supercharger is used to compress the thin high-altitude air to sea-level density.

Many supercharger parts, such as impellers, call for finest and most accurate finish, which is accomplished on Monarch-Keller lathes four to five times faster than by any other means.

The impeller is held in a fixture fastened to the faceplate. A single-point tool machines the outer edge to an angle and a blended radius. With electric controls, the tool is guided automatically by a thin metal template to follow exactly the contour required to give the impeller maximum efficiency and dependability.

Electric controlled Monarch lathes are performing intricate contour jobs in hundreds of war plants with dependability and speed. You, who are using Monarch lathes to produce implements of Victory, can do so with the assurance that they'll never let you down!

THE MONARCH MACHINE TOOL COMPANY • • • SIDNEY • OHIO



Simple or complicated contour turning, boring or facing can be done on the Monarch-Keller lathe with the same ease and precision as finishing this airplane part or supercharger impeller blades which enable our bombers to breathe sea-level air at 35,000 feet.

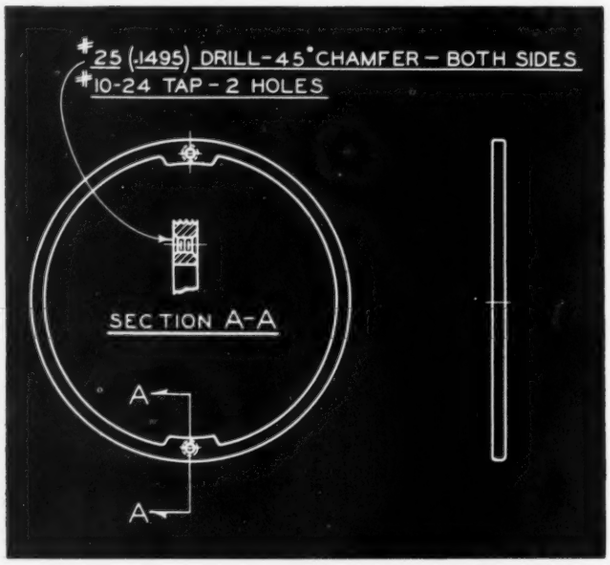
MONARCH LATHES

COVER THE TURNING FIELD

FLEXIMATIC

by KINGSBURY

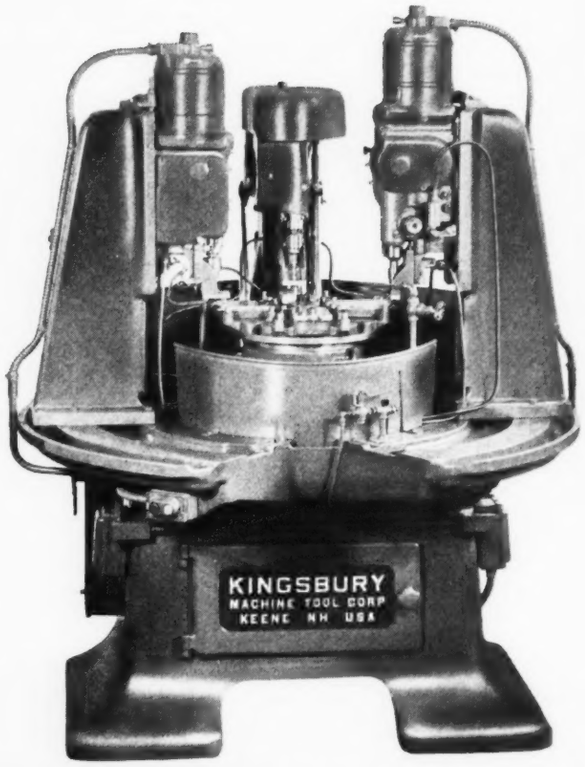
Aircraft Accuracy at War Production Speeds

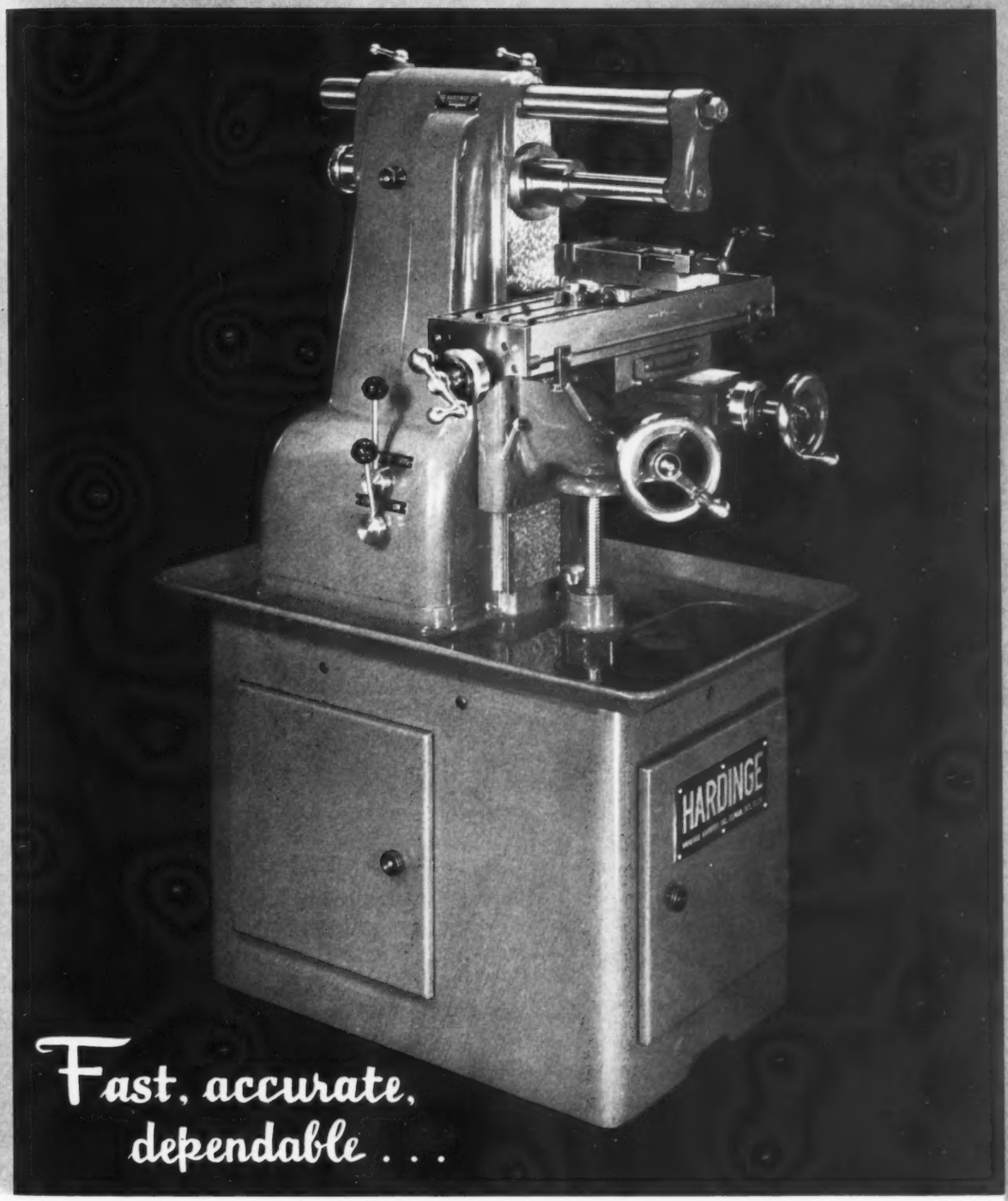


THIS IS ANOTHER

Fleximatic AIRCRAFT JOB!

Insuring accuracy and concentricity by performing several operations in one chucking, speeding output by reducing work-handling, FLEXIMATICS are producing parts for many important aircraft applications. The FLEXIMATIC illustrated, for instance, is used for drilling, countersinking and tapping two holes in a stop pitch ring for airplane propellers as shown in the drawing above. This machine is typical of the many FLEXIMATICS that are now engaged in war production on parts for automatic rifles, bomb and shell fuses, aircraft engines, propellers, controls and instruments. In every branch of war industry FLEXIMATICS are helping to attain the goal of high speed mass production by speeding up multiple operations, performing drilling, tapping, reaming, spotfacing, milling, chamfering and similar jobs, simultaneously or in sequence. The FLEXIMATIC method of performing a series of operations in a single chucking of the work enables semi-skilled operators to perform quality work at high production speeds.





Fast, accurate, dependable . . .

Fast, accurate, dependable . . . these three words are constantly mentioned when users state their experience with HARDINGE High Speed Precision Milling Machines.

Ruggedness is combined with extreme accuracy for ease of operation . . . high spindle speeds insure better finish as they afford proper cutting conditions.

Ask for our latest bulletin giving complete details.

SPECIFICATIONS:
Table: 25" x 6-1/2".
8 Speeds: 110 to 1850 R. P. M.
Cutter and Index Head have 1" Collet Capacity

"Performance has established leadership for **HARDINGE"**

HARDINGE

HARDINGE BROTHERS INC., ELMIRA, N.Y., U.S.A.

HOW AND WHY
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools,* BUFFALO, N. Y.

DATA ON WILLIAMS' BORING TOOLS

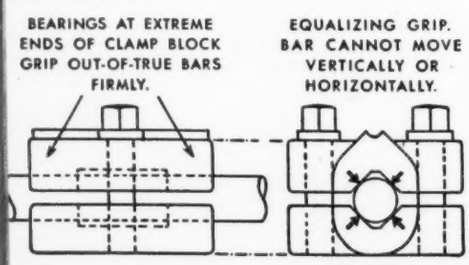
For those lathe operations involving boring and internal threading, Williams' Tools incorporate certain features which tend to conserve man-hours, improve output, and to reduce the number of rejects, particularly with semi-skilled and inexperienced operators.

Sleeve Bar

Plain Bar

Williams' Series 80 Boring-Tool Holder

Williams' Boring-Tool Holders (80 series) are designed so that *each* holder will accommodate *several* sizes of bars and so that commercial forms of bar steel are adaptable for either bars or cutters without machining. Adjusting sleeves or bushings are not used with this holder so there are no loose parts to become misplaced or lost. The "V" Block clamping arrangement, sketched below, grips even undersize or out-of-round bars firmly at four points, thus preventing tool chatter.


BEARINGS AT EXTREME ENDS OF CLAMP BLOCK GRIP OUT-OF-TRUE BARS FIRMLY.
EQUALIZING GRIP. BAR CANNOT MOVE VERTICALLY OR HORIZONTALLY.

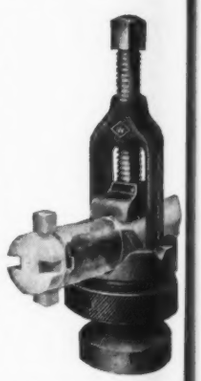
Simplicity of design and sufficient stability to assure freedom from tool chatter are essential features in Tool-Holders for war production.

The Sleeve Bar regularly furnished accommodates either a straight or angle cutter in the *one* head, so there is no extra head to be misplaced while the other is in use. A Plain Bar, as illustrated above, can also be supplied if specified. Series 80 Holders are made in 5 sizes covering bar diameters from 3/16″ to 1-1/8″.

Williams' Light Boring-Tool Holder

For tool room use and all small work—including turning, as well as boring and threading—Williams' Light Boring Tool Holder incorporates certain distinctive features. In boring and internal threading operations each holder will take several sizes of bars. Easy, rapid adjustment is assured with the knurled adjustment screw. When used as a Turning Tool Holder the offset shank makes it reversible for right and left hand work. This Holder is made in 3 sizes accommodating bars from 1/8″ to 7/16″ in diameter.

Williams' Adjustable Boring-Tool Post

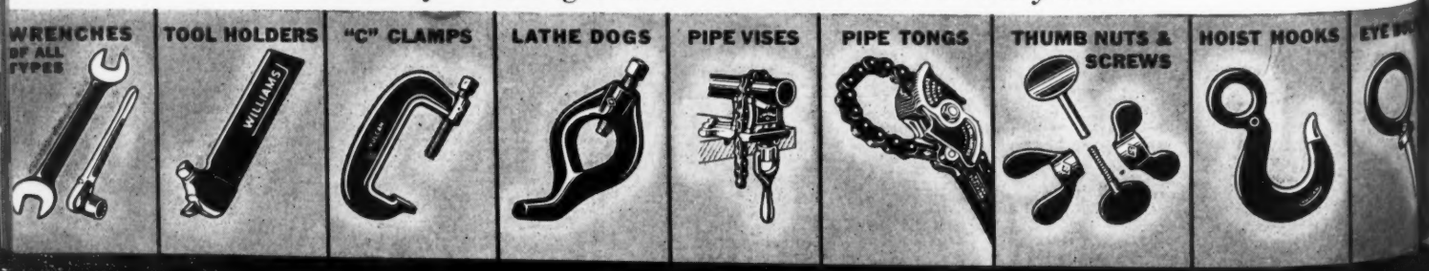


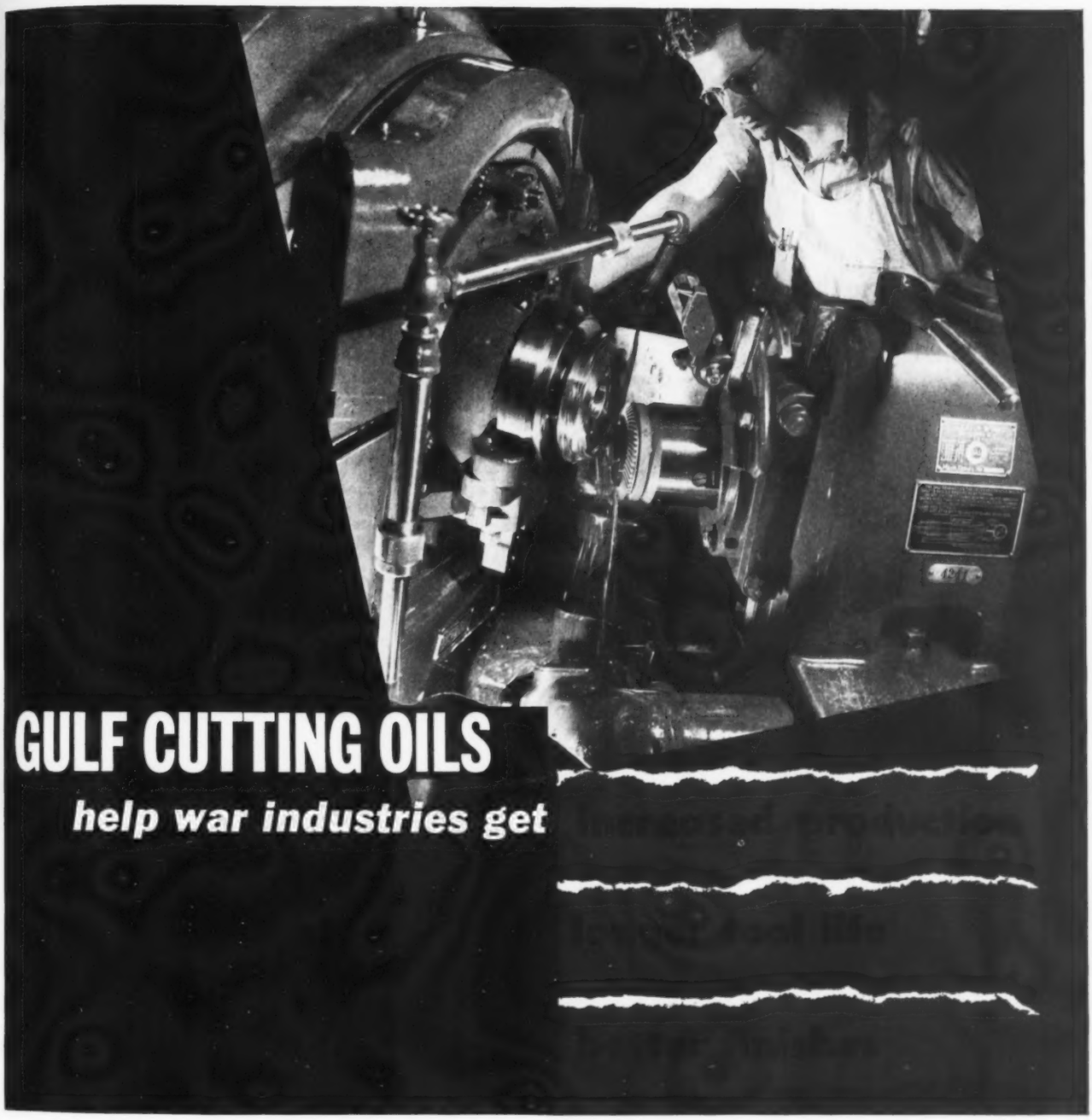
The Williams' Adjustable Boring-Tool Post, with its long range center adjustment, is designed to accommodate many sizes of bars on various types of lathes. Easy, quick, vertical adjustment is accomplished by first selecting the proper bar recess in the slotted collar and then rotating the knurled ring which raises or lowers the bar to the correct height. Tightening the set screw in the head of the post tightens the whole device instantly, giving an extremely rigid tool. For all phases of boring and internal threading this vertical adjustment permits proper centering rapidly and assures perfect performance. The "V" block bar clamping construction grips the bar at four points which eliminates vertical or horizontal movement, thus preventing chattering.

Made in 4 sizes for bars 1/2″ to 2-1/4″ diameter.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere





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Sanding and finishing ornamental bronze. Photo courtesy of

General Bronze Corp.
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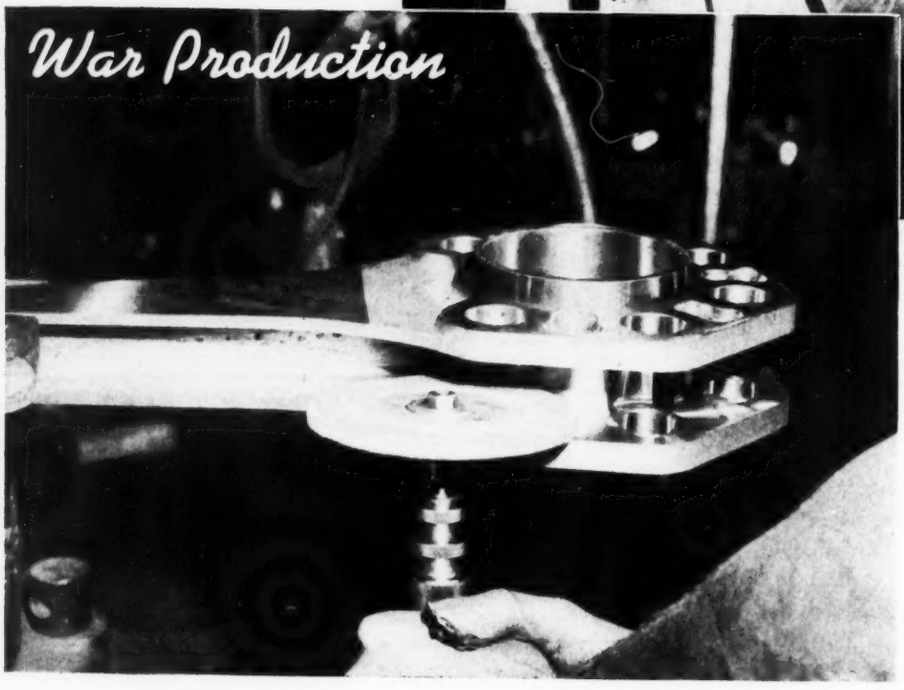

Finishing aircraft engine master rod. Photo courtesy of

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MORE PRODUCTION
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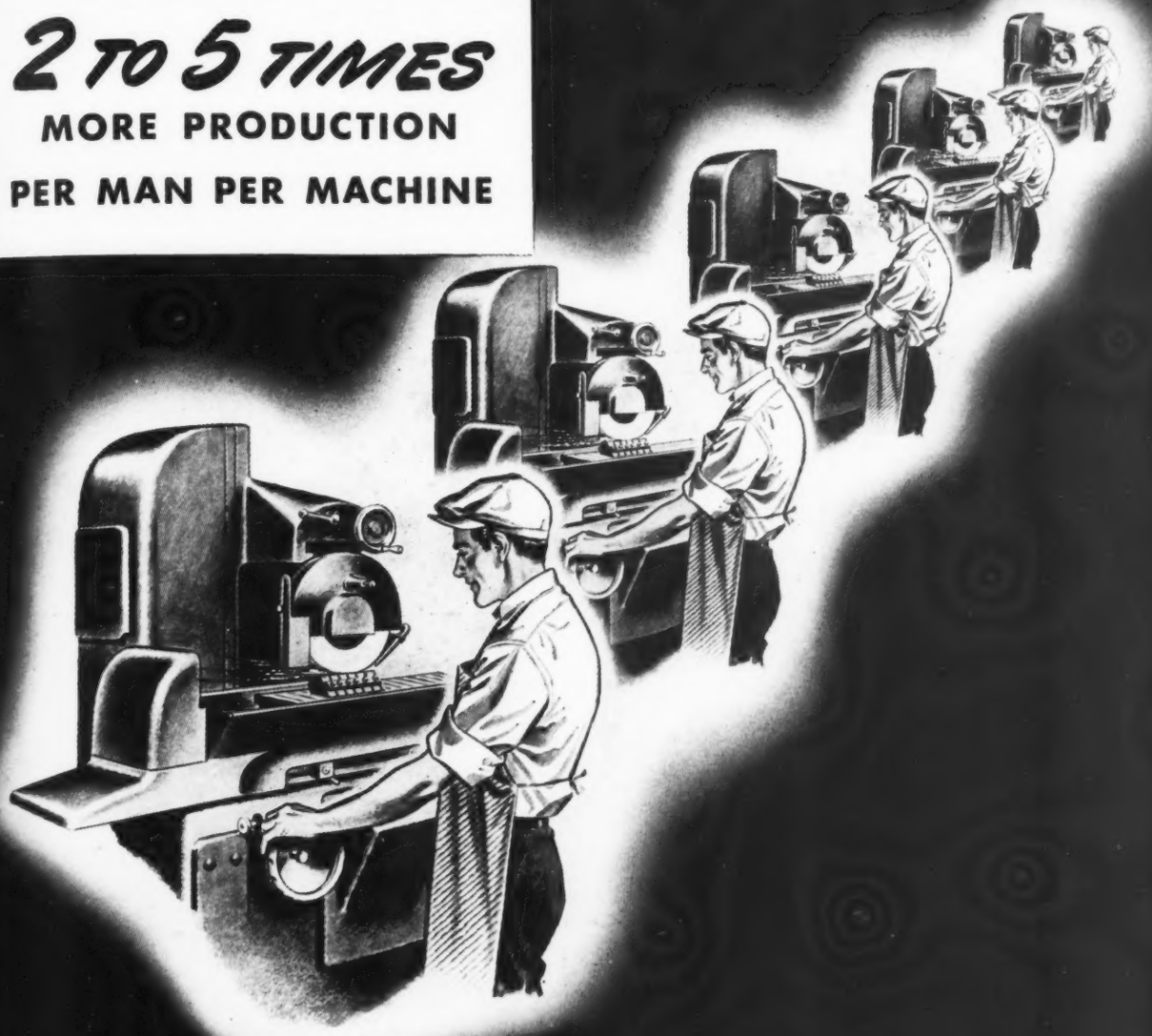

This new precision grinding wheel "breathes." Millions of air cells cool. Result: 100% to 400% faster cutting

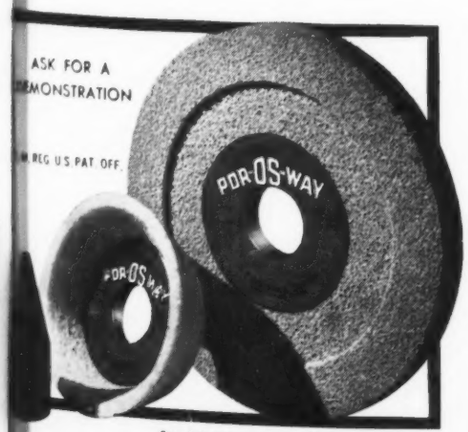

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FIGURE THE EFFECT on your production of speeding up grinding from 100% to 400%. This new grinding wheel may do it for you, too.

The principle of Por-os-way is new. The method of manufacture is new. The bond used is new. Instead of a "sandy" or compact structure, Por-os-way is *cellular* and "stringy" like a sponge; contains millions of air cells which cool each grinding point between contacts.

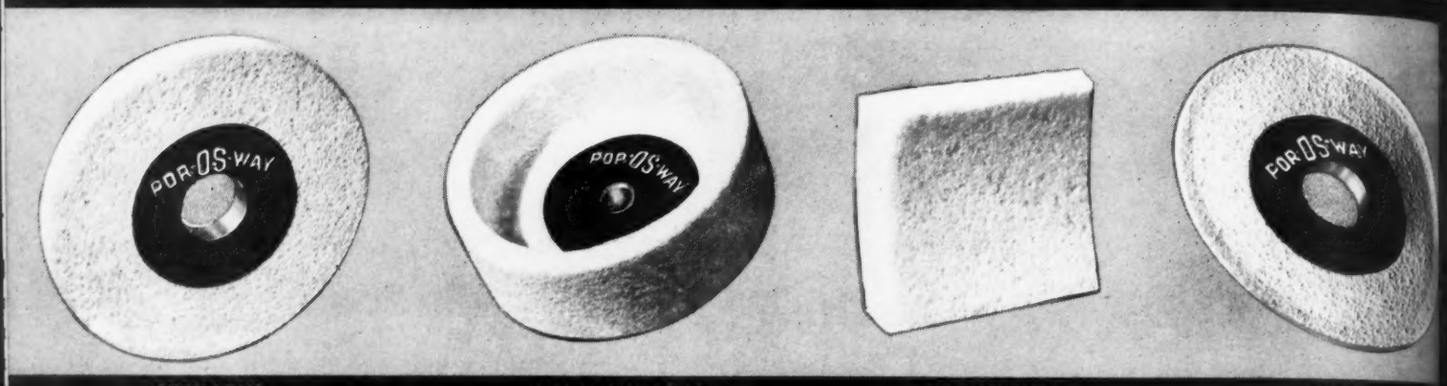
Por-os-way takes deeper cuts, breezing through .010" or more. It grinds from 100% to 400% faster. It increases production per man, per machine 2 to 5 times. And that's not all. Por-os-way shows little tendency to load or burn the work. Use it on hard tool and die steels. It is hard, tough, holds its corner with very little dressing.

On soft materials—copper, rubber, wood, plastics—Por-os-way is free cutting and does not easily load. Make a test! Write today for the booklet that "tells all" about Por-os-way and that opens the way for the prescription of porosity, grade and grain best fitted for your job. Por-os-way wheels are not "stock" wheels. A. P. DE SANNO & SON, INC., 428 Wheatland St., PHOENIXVILLE, PA.

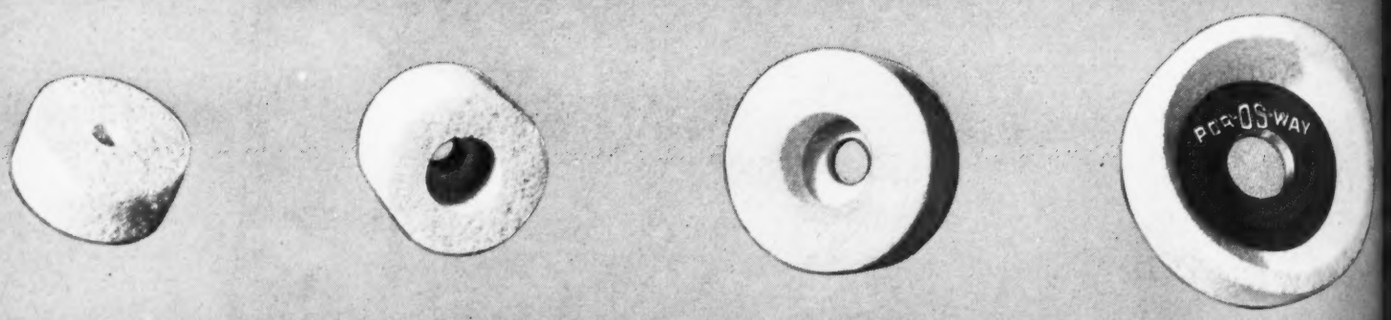
POR-OS-WAY* *a new* **RADIAC* PRODUCT**

(TURN PAGE, PLEASE)

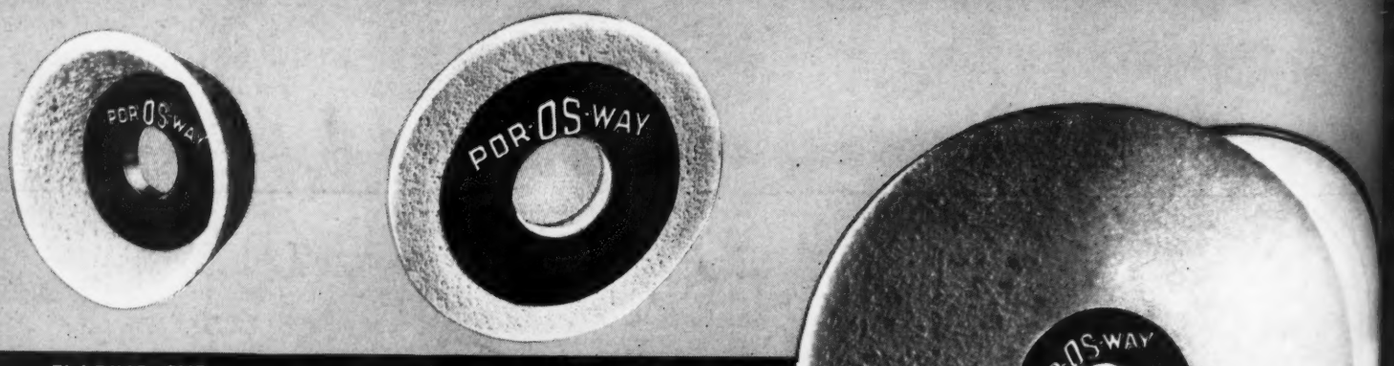
A PRECISION WHEEL FOR PRECISION PURPOSES AND EVERY WHEEL A POR-OS-WAY



STRAIGHT | STRAIGHT CUP | SEGMENTS | DISH



STRAIGHT | STRAIGHT RECESSED | STRAIGHT RECESSED | STRAIGHT CUP



FLARING CUP | STRAIGHT

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

DO THIS—MAKE THE LIGHT TEST

Hold a Por-os-way wheel up to a light bulb. Note the even spread of light. No soft spots to wear away quickly, no dense spots to encourage glazing. The light is evenly diffused. The uniform structure of the wheel gives you uniform wear.

Modern H·P·M FASTRAVERSE PRESSES are setting new production standards in precision forging of high explosive shells . . .

HPM

Two operations are performed by the drawing press. The pierced slug has just been bottomed and is now ready to be forced through the draw rings of the lower die.

Removing a hot steel pierced slug from the piercing press, the first operation in forging a high explosive shell.

Two HPM FASTRAVERSE Presses are used to forge high explosive shells. Press at right pierces the hot slug; second press (left) draws the slug to the proper length and section. Only one heat is required. ● Average production for one line of two presses is in the neighborhood of three thousand 90 mm shell forgings every 24 hours. Final rejections low, averaging only 2½% of the total production. Write for complete details. » »

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Pioneer builders of high speed self-contained hydraulic presses
District Sales Offices: New York, Syracuse, Detroit and Chicago
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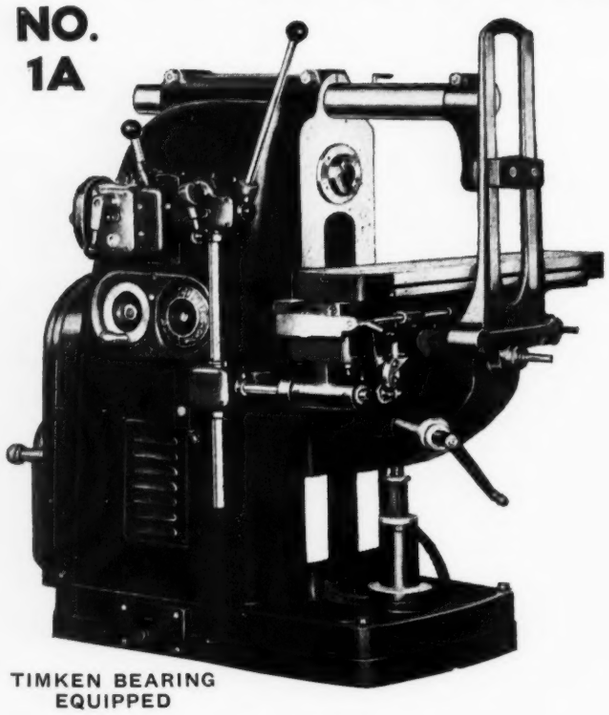
Quick Delivery!

MILLING MACHINE

WITH *MICRO-SPEED DRIVE*

NO. 1A



TIMKEN BEARING EQUIPPED

- SELECTOR DIAL CONTROL
- SPINDLE BRAKE and CLUTCH

Here's the ideal milling machine for small parts production. The Micro-Speed Unit, mounted inside the streamlined column (as shown in inset) provides the operator with a wide range of spindle speeds. Selector Dial Control selects the desired speed instantly, at the turn of the hand wheel adjacent to the dial on the column. All Controls on One Side of Machine for Easy Access.

The table is supported on extra long double V-slides cast in the saddle and is provided with adjustable aligning gibs to compensate for wear. Positive automatic longitudinal power feed supplied to the table. All feeds provided with adjustable dials graduated to thousandths of an inch.

SPEEDS	RANGE OF FEEDS
56 to 630 R.P.M. Equipped With Spindle Brake	Longitudinal, 34"; Cross, 8"; Vertical, 18½"

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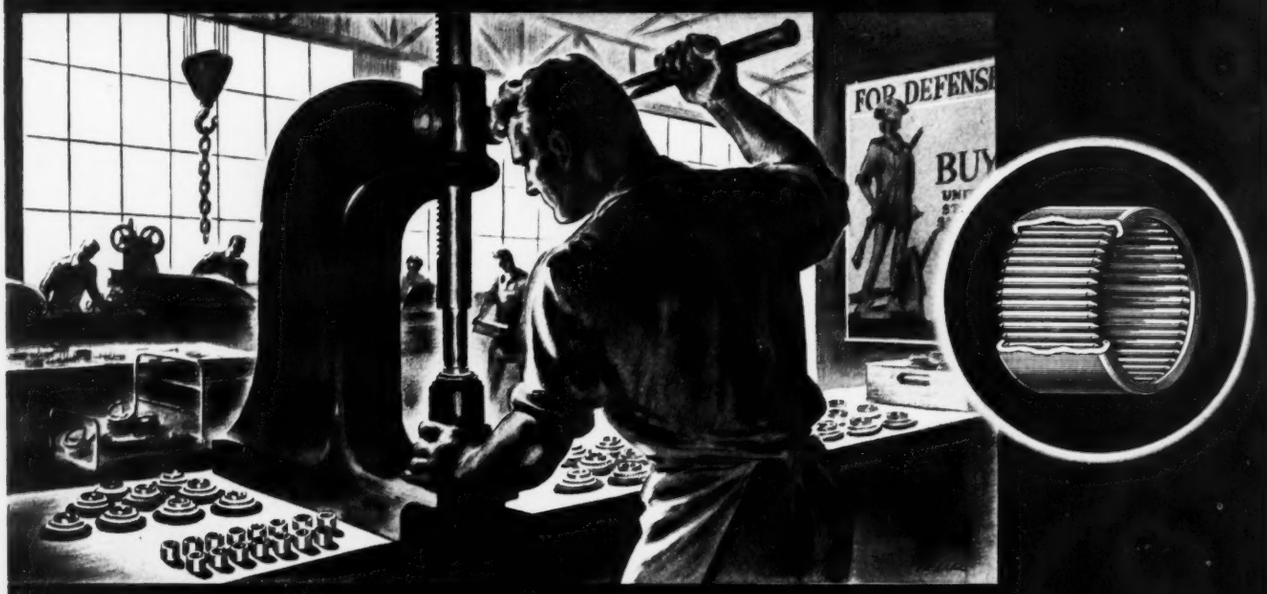


NEW ASSEMBLY LINES

NOW it's aircraft engines where sedans "used to grow"... or plastics instead of critical metals... or welding replacing rivets. The man on the assembly line has *seen* the changes taking place—one after another.

One thing, though, hasn't changed—merely "changed over" to war production. In the Torrington Needle Bearing, veteran production men recognize an old familiar name. For this unique bearing is proving its adaptability anew, in applications where its advantages mean more today than ever.

Its ease of installation, for example, is cutting assembly time... enabling green hands to "catch on" more rapidly, experienced hands to work with the speed and efficiency war production schedules demand.

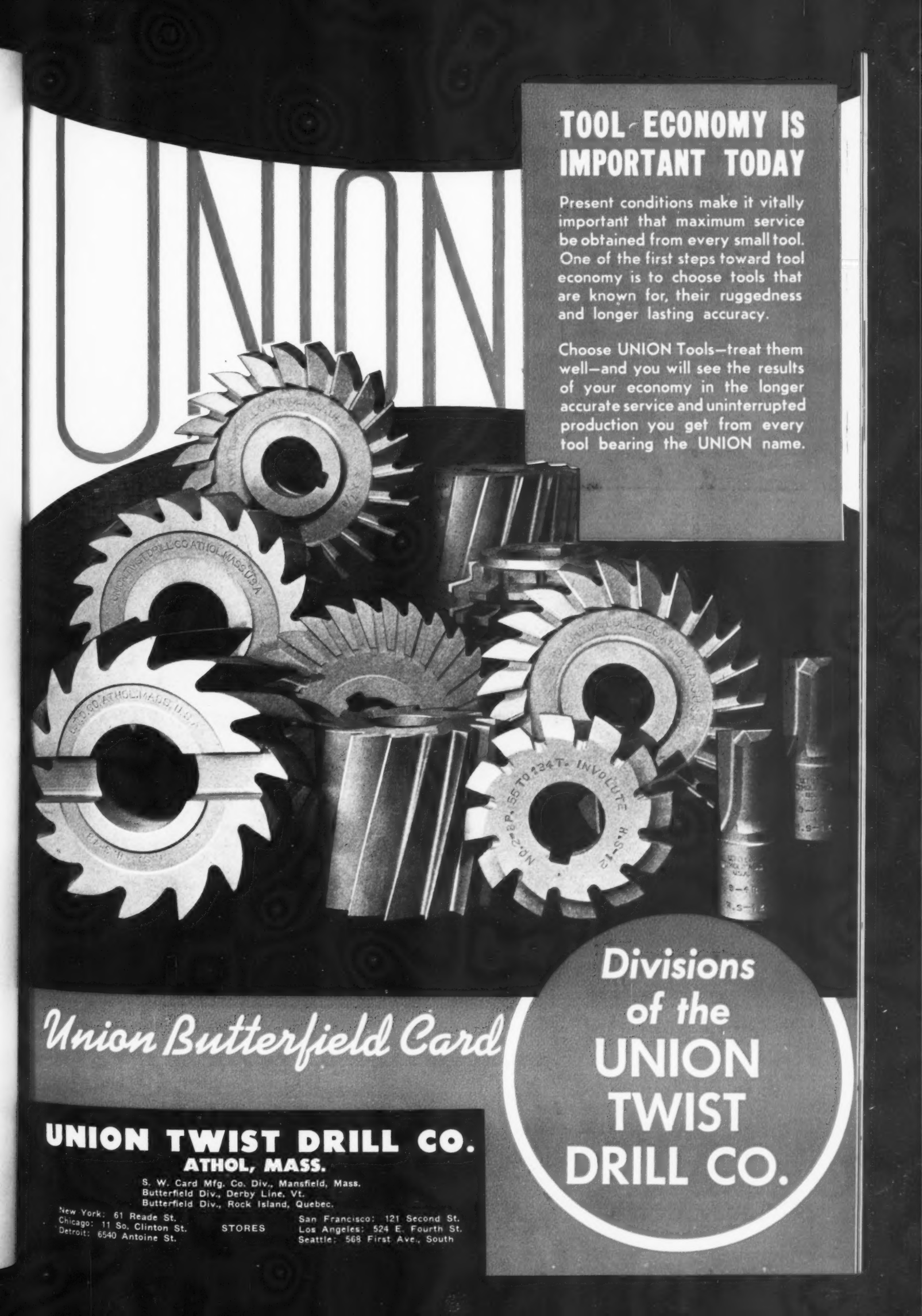
Every feature of the Needle Bearing, in fact, is filling some vital wartime need. Its small size is saving space and critical materials; its simplified design is eliminating extra parts and assembly steps; its low coefficient of friction, assuring smooth performance ... high capacity and efficient lubrication, reducing the need for replacement or maintenance attention.

And so it is easy to understand why the Torrington Needle Bearing is in service today on new assembly lines all over America—assembly lines geared to production-for-Victory.

***FOR INFORMATION** concerning capacities and sizes, send for Catalog No. 111. Or consult a Torrington engineer. He is an expert in adapting the Needle Bearing's unique advantages to specific problems.*

THE TORRINGTON COMPANY
TORRINGTON, CONN., U. S. A. • *Est. 1866*
Makers of Needle and Ball Bearings
New York Boston Philadelphia Detroit
Cleveland Seattle Chicago Los Angeles
San Francisco Toronto London, England

TORRINGTON NEEDLE BEARING
Every feature fills a wartime need


UNION
TOOL ECONOMY IS IMPORTANT TODAY
Present conditions make it vitally important that maximum service be obtained from every small tool. One of the first steps toward tool economy is to choose tools that are known for, their ruggedness and longer lasting accuracy.
Choose UNION Tools—treat them well—and you will see the results of your economy in the longer accurate service and uninterrupted production you get from every tool bearing the UNION name.
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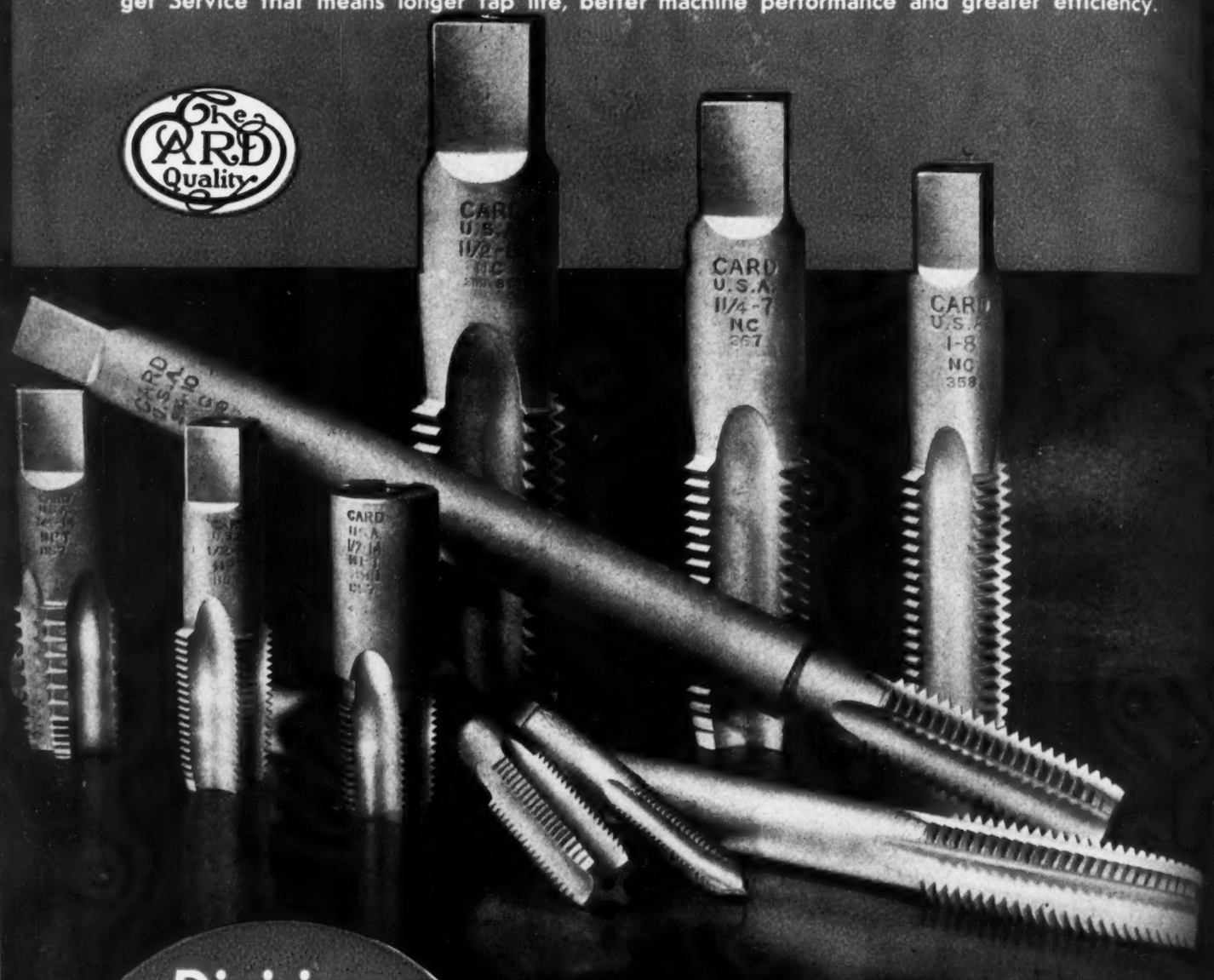

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Reamers that are **right**—for jobs that demand the utmost in precision . . . for trouble-free, tool-saving performance under heavy high production demands . . . for results that satisfy in every material, all types of work.

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THE *Lees-Bradner*

MODEL CT

THREAD MILLING MACHINE

The Lees-Bradner Model CT Machine is suitable for the generation of threads using either a single cutter or a ring (hob) type cutter, since the cutter head is actuated by a precision lead screw, thereby enabling users to take advantage, not only of the benefits of hob type thread milling, but also when the occasion demands it, to use the same machine for single cutter work.

The Model CT machine is particularly suitable for the larger, more complex parts requiring the ultimate in precision threads, items such as oleo struts, breech rings, propeller blades, and other similar larger components.

LEES-BRADNER BUILDS A COMPLETE LINE OF THREAD MILLING MACHINES.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

Men are Dying . . . Furnaces are Cold

—But you don't care!

IT IS difficult to believe that there are men who don't care—perhaps it's a case of not fully realizing the situation, but here are the facts.

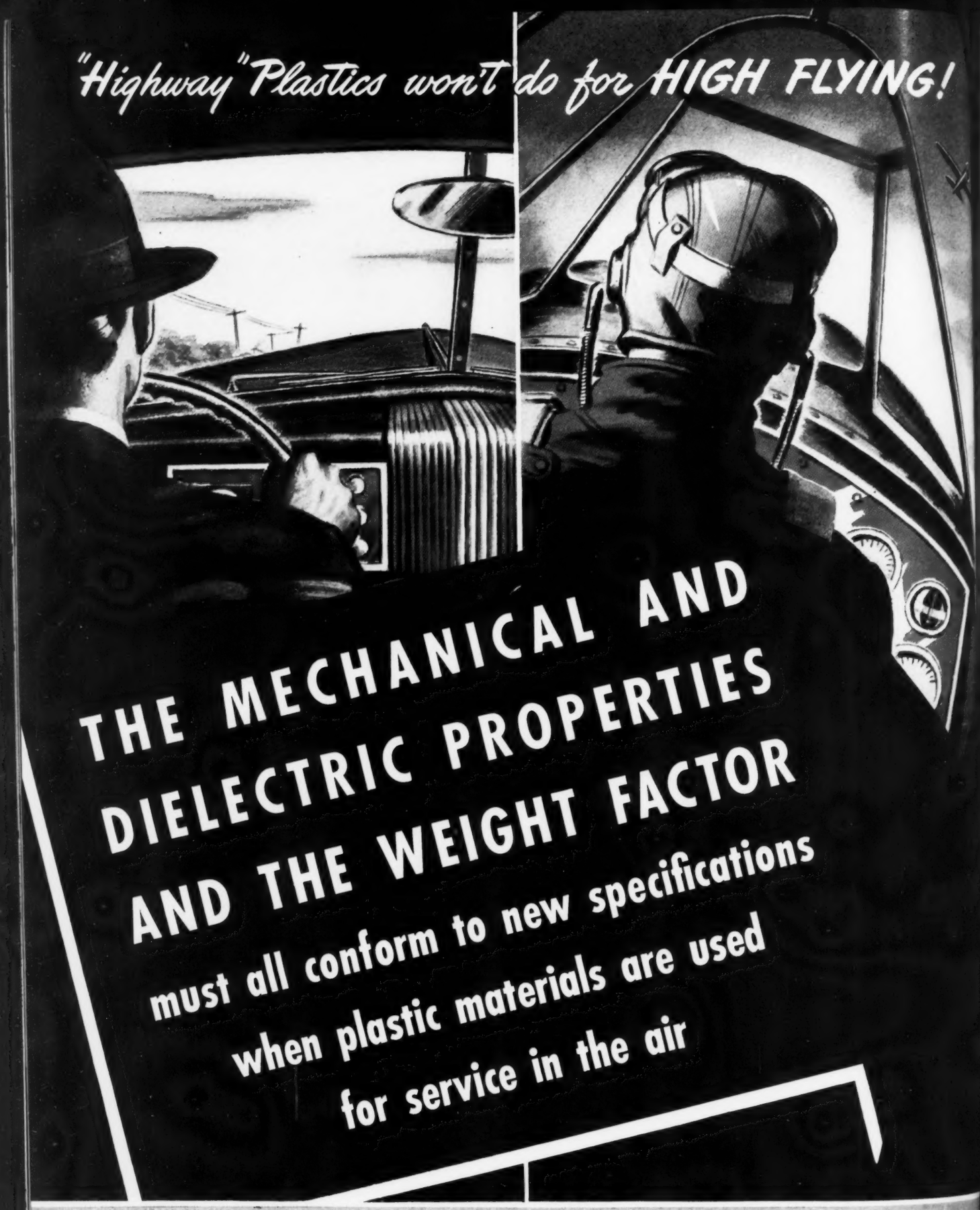
Our boys are fighting, dying at the front. They need steel to protect them, weapons of steel to fight with, and yet some furnaces are cold that should be making steel night and day. With thousands of tons of scrap lying around the country, there is not enough gathered in to keep all the furnaces going, to say nothing of building up a back-log for the winter months.

Steel is usually made of 50% pig iron and 50% scrap. The blast furnaces are operating 24 hours a day making all the pig iron possible, so the only chance of increasing our steel output is to get more steel scrap.

Your production scrap is, of course, collected in the routine way, but it is the broken and obsolete equipment, the old jigs, tools, dies, parts, etc. that are not moving, and they can not move without your authority.

So make a thorough recheck of your plant, storage rooms and equipment yards. Give orders to scrap everything that is not needed for current operations. The need is so critical that we can not urge you too strongly to act at once.

RYERSON STEEL-SERVICE


"Highway" Plastics won't do for HIGH FLYING!
THE MECHANICAL AND DIELECTRIC PROPERTIES AND THE WEIGHT FACTOR must all conform to new specifications when plastic materials are used for service in the air

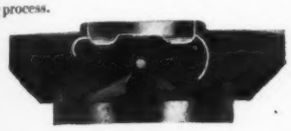
3 Ways "BAKELITE" PLASTICS HEADQUARTERS Help Speed Production

1 LITERATURE ON "DO'S" AND "DON'T'S" OF PLASTICS . . . Helpful technical booklets containing data on types and forms of BAKELITE plastics, and the most efficient methods of fabrication. This literature will help you to choose the right plastic for each job, save time and avoid errors.

2 GEARING OUR LABORATORIES TO YOURS . . . Bakelite Laboratories offer a two-fold service. They are ready to help you utilize present plastics in war production. They will also develop new formulas to help solve the problems of highly specialized requirements.

THIS PICTURE STORY of a molded component for aircraft engines illustrates how it is possible to meet these new requirements by combining the correct plastic materials with proper designing skill and fabricating technique.

1. Material "A," the first choice of materials for this electrical part, is a low-loss type of plastic used generally for radio insulation. But, the part failed in arc-over at reduced pressures due to high elevation and also in dielectric breakdown because of incorrect design. Also, as the sectional view shows, cracks occurred when the sprue was broken while opening the mold, caused by lines of weakness set up by improper flow properties of this material in this particular molding process.

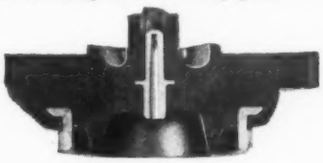


2. By a radical redesign of the plastic part and its meta inserts, dielectric failure was remedied completely. However, cracking still presented a problem which the design engineers attempted to solve by switching to material "B," and by building a proper jig to remove the molded part squarely from the mold itself.

3. Yet, cracks still occurred when the metal sections were machined after molding. Material "C" was then tested in order to obtain better machining strength. Although this tougher plastic machined satisfactorily, there was still evidence of continued cracking over the "ears" of the molded piece.

4. By filing smooth the corners of the ring inserts before they were inserted in the mold, internal strains were relieved, thus eliminating some of the cracking difficulty. This combination of material "C" with the redesigned metal inserts proved satisfactory mechanically, but the material lacked the required dielectric strength.

5. It was thereupon decided to revert to material "B." However, in order to obtain the necessary mechanical strength, the metal inserts were again redesigned to offer less resistance to the shrinkage of the plastic material. In addition, a circumferential slot was turned in the ring insert to a proper depth which made it possible to machine the part after molding without exposing sharp corners. This corrected all cracking due to machining operations.



6. Despite this improvement, two types of cracks still occurred. One was a radial crack on the face of the ring originating at the small round center insert. Another was located in the recess of the base of the tower. The recommendation that preheating time be increased and that plasticity be changed from flow 100 at 300 lb. per sq. in. to flow 100 at 500 lb. per sq. in. resulted in definite improvement.

7. As a final step, the mold was redesigned to provide a more even distribution of the mass of the plastic material, and the area around the center insert in the face of the piece was reinforced with a BAKELITE phenolic molding blank. These changes reduced cracking to an absolute minimum. They also lightened the weight of the final molded piece—an important factor for producing parts for aircraft use.

NOWHERE will you find higher standards of efficiency than in the engineering of automotive plastics. But plastics for combat flying are subjected to shocks, stresses, and climatic conditions that only products engineered for this service will withstand. Manufacture of parts that rate 100 per cent on *all counts* brings extreme problems that demand the closest co-operation between designer, materials' supplier, and manufacturer.

In the case of the aircraft component shown here, each requirement was met step by step . . . each new problem solved by experiment and test as it appeared. Molding materials were changed, and changed again, before one was found that would neither crack under unusual mechanical strains nor fail when subjected to severe electrical breakdown tests. Designs had to be altered, and revisions made in molding technique, in order to meet completely, on a productive basis, the necessary mechanical and dielectric requirements.

When you are confronted with problems such as these, Bakelite Plastics Headquarters can help to avoid costly and time-consuming experimentation, and assure maximum service life for strategic plastic products.

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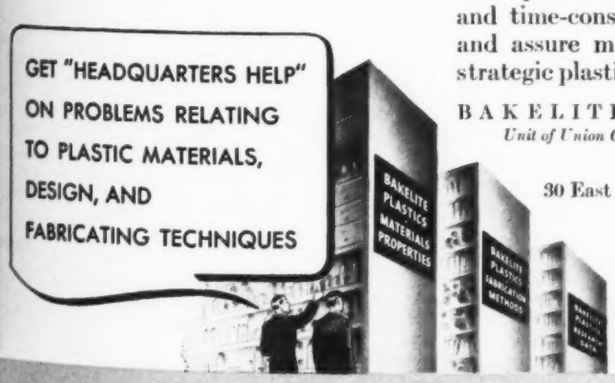

and Conserve Strategic Materials

3 FIELD WORK ON "FRONTLINE" JOBS . . . Located at important industrial centers throughout the nation, Bakelite Field Engineers are ready to give prompt service to manufacturers engaged in war production. Fully qualified, they can frequently solve production problems on the spot.

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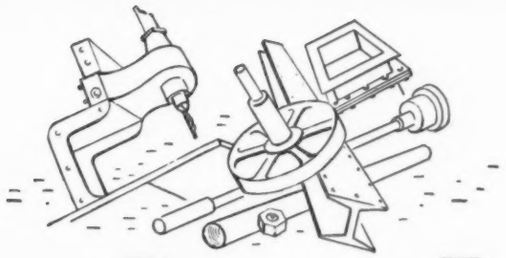

Your Scrap Iron and Steel is Needed Now!

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6,000,000 EXTRA TONS MUST BE OBTAINED TO KEEP WAR PLANTS WORKING

We've got to win this war. To win it, we must have equipment. That takes steel—millions of tons of it. And to make the steel, more scrap is needed.

Look around your plant or shop. Any old machines, line shafting, pumps, gears or other obsolete, broken or worn-out equipment—any old dies, jigs, templates, rolls, patterns, molds, tools or fixtures—any old pipe, valves or hardware—old autos and trucks—anything made of iron or steel that you can dig up or tear down will mean more tanks, airplanes, ships, guns, shells and other armament.

Many millions of tons of scrap iron and steel will be turned back to steel producers this year. . . . . .

BUT IT WON'T BE ENOUGH!

6,000,000 EXTRA tons are *urgently* needed —because, on the average, every ton of open-hearth and electric furnace steel produced today is made up in half by scrap. The steel industry must get that quantity to produce the steel required to keep war production plants running full time this fall and winter.

Start a special scrap gathering campaign *today,* with a competent man or committee in charge. Tell every man in your plant about it—for his job, his home, even his life, may depend upon it. Post this story on your bulletin boards (we'll gladly send reprints). You'll be surprised how much *EXTRA* scrap iron and steel you can find in your plant and at home, too.

Then call your nearest junk or scrap dealer. Sell it to him, and he'll move it along to the steel mills.

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METHOD 5

Vascoloy RAMET

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Where cemented carbide can't be used, Tantung "G" offers the ultimate in maximum production. Figure it out for yourself what it would mean if you could increase your cutting speeds 50% and get six or seven times as many pieces per tool sharpening. These figures are not at all the maximum that is being obtained. And these tools work equally well on non-ferrous metals, cast iron and steels.

It's so easy too, to make the switch to Tantung "G". Tools are available as standard in a wide variety of sizes in solid tool bits, all purpose tools, cutting-off tools, and as blades for inserted tooth milling cutters. Tools to order can be made for the unusual setup.

You owe it to yourself to get full particulars at once.

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Two TOOL STEELS CAN CUT AS CHEAPLY AS ONE

WHAT'S more important, two tool steels can cut twice as *fast* as one, and speed is the prime urgency in war production.

But there are ways of increasing production beside installing more modern types of machine tools. A better tool steel, or one better suited to an individual job, can materially speed up the work your existing equipment is capable of doing.

Take the case of a big Detroit plant, using DBL High Speed Tool Bits instead of a high-tungsten variety, machining castings of X-1340 steel with a surface hardness of 33 Rockwell C, and a subsurface hardness of 26-28C. The DBL Tool Bits showed 30% increase in work done between grinds, running at 166 RPM against a previous speed of 100 RPM.

Our Service Staff is ready to help you team up tool steels with your production jobs, for more work done per machine. They'll show you the best *alternate* steels, too, as a precaution in keeping the lines moving.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

HOW HARD-FACING *saves Time, Power, and Materials*

What Hard-Facing Is

Hard-facing is the process of welding on to wearing parts a coating, edge, or point of a hard metal —usually a special alloy possessing exceptional wear resistance. By this method, it is possible to protect metal surfaces that normally wear away rapidly in service. This process can be applied with equal advantage to new parts before they are used, or to worn parts.

Hard-Facing Increases Service Life

Hard-facing gives considerably longer life to wearing parts of many different kinds. Depending on the hard-facing rod used and the service to which the part is subjected, a hard-faced part will last from two to twenty-five times longer than a steel part that has not been protected by this method. Most parts can be hard-faced again and again.

Less Shutdown Time

As a result of the increased life of hard-faced parts, fewer shut-downs for replacements are necessary. This avoids lost time for both labor and equipment. In addition, problems of obtaining replacement parts are often completely eliminated.

Less Steel Waste

Many parts that would otherwise have to be sent to the scrap pile can be salvaged by hard-facing and quickly put back into service at a cost considerably less than that of replacement with new stock. And since such salvaged parts usually can be hard-faced repeatedly, it is possible to reduce the stock of reserve parts.

Lower Power Consumption

Parts that are used to cut, scrape, or drill stay sharp longer when they are hard-faced. This reduces power consumption, and helps maintain a uniformly high overall efficiency.

Substitute Base Metals

Substitute base metals that are more readily available than special steels can often be used in the fabrication of parts if hard-facing is employed. The metal can be selected for core properties without regard to wear resistance, and wearing surfaces can then be protected by the welded-on hard-facing deposit.

Haynes Stellite Rods

Haynes Stellite Company has a hard-facing material for every type of application. Whenever abrasion, heat, or corrosion takes its toll, there is a Haynes Stellite rod to provide lasting protection. *Write to any district office for a copy of the informative booklet, "Hard-Facing Materials Data".*

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

"War-Made Friends"

Other Special INGERSOLL Sheet Steels include:

- Alloy Steels
- Armor Plate
- Clutch Plate Steels
- Tillage Steels
- Soft Center Steels
- Shovel Steels
- Knife Steels
- TEM-CROSS Steel
- IngAclad (Stainless-Clad Steel)
- Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

In a great many plants Ingersoll D-B-L Steel has made warm friends of those who buy and use Hack Saw Blades . . . In some cases only the necessary conservation of vital alloys gave D-B-L a reluctant first trial . . . Today in these same shops D-B-L is enthusiastically accepted and approved because it is so high in impact resistance, provides so tough a cutting edge, and is so relatively free from decarburization.

These advantages, plus *lower cost*, have won for Ingersoll D-B-L Hack Saw Steel a permanent place along with Ingersoll 18-4-1 and Molybdenum which were pre-war favorites.

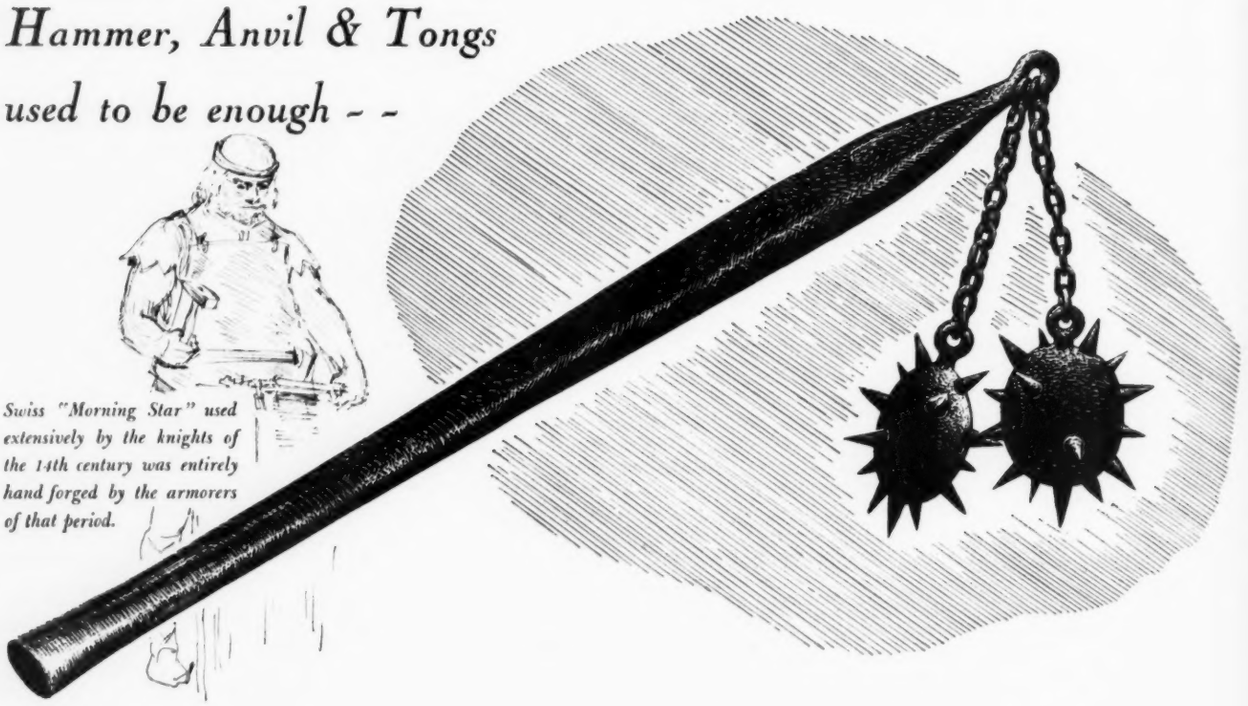
Specify Ingersoll D-B-L Steel on orders for Hack Saw Blades

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
New Castle, Indiana
Plants: New Castle, Ind.; Chicago Ill.; Kalamazoo, Mich.

INGERSOLL SPECIAL STEELS for SPECIAL USES

Hammer, Anvil & Tongs

used to be enough - -



Swiss "Morning Star" used extensively by the knights of the 14th century was entirely hand forged by the armorers of that period.

- - BUT PRODUCTION OF MODERN WEAPONS DEMANDS DEPENDABLE TOOL STEELS

Tool steel plays an essential part in every step of the complex manufacturing operations required to complete the tanks, planes, ships, guns and all the other implements of modern warfare. Tool steel performance must be dependable to avoid loss of production, time and the waste of materials. Coppco tool steels are making good dependability records. We would like to discuss your tool steel requirements with you.

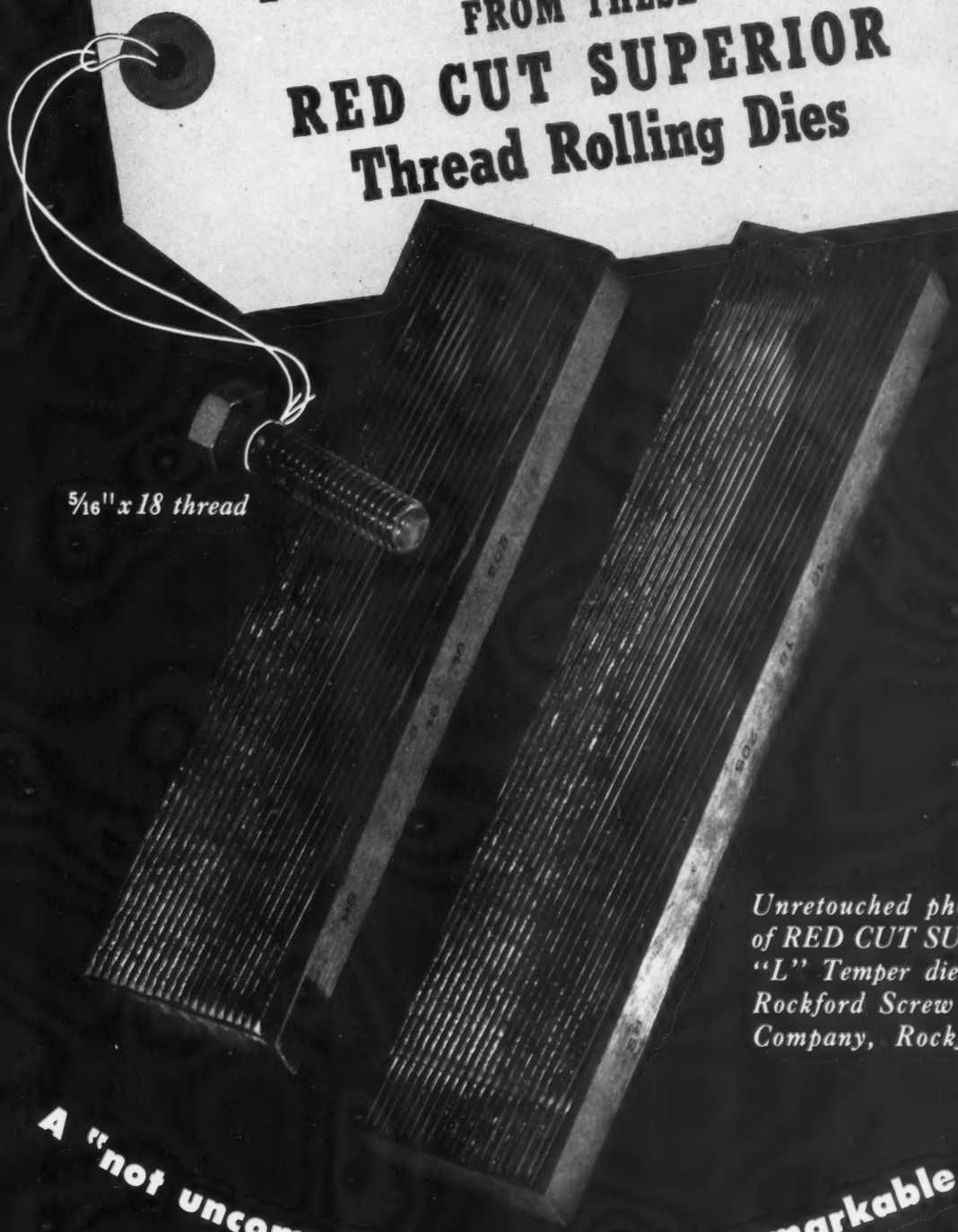
FOR DEPENDABLE PERFORMANCE--

COPPCO TOOL STEELS

THE WILL TO MAKE GOOD STEEL

COPPERWELD STEEL COMPANY • WARREN, OHIO

2,434,000
PERFECT CAP SCREWS
FROM THESE
RED CUT SUPERIOR
Thread Rolling Dies



5/16" x 18 thread

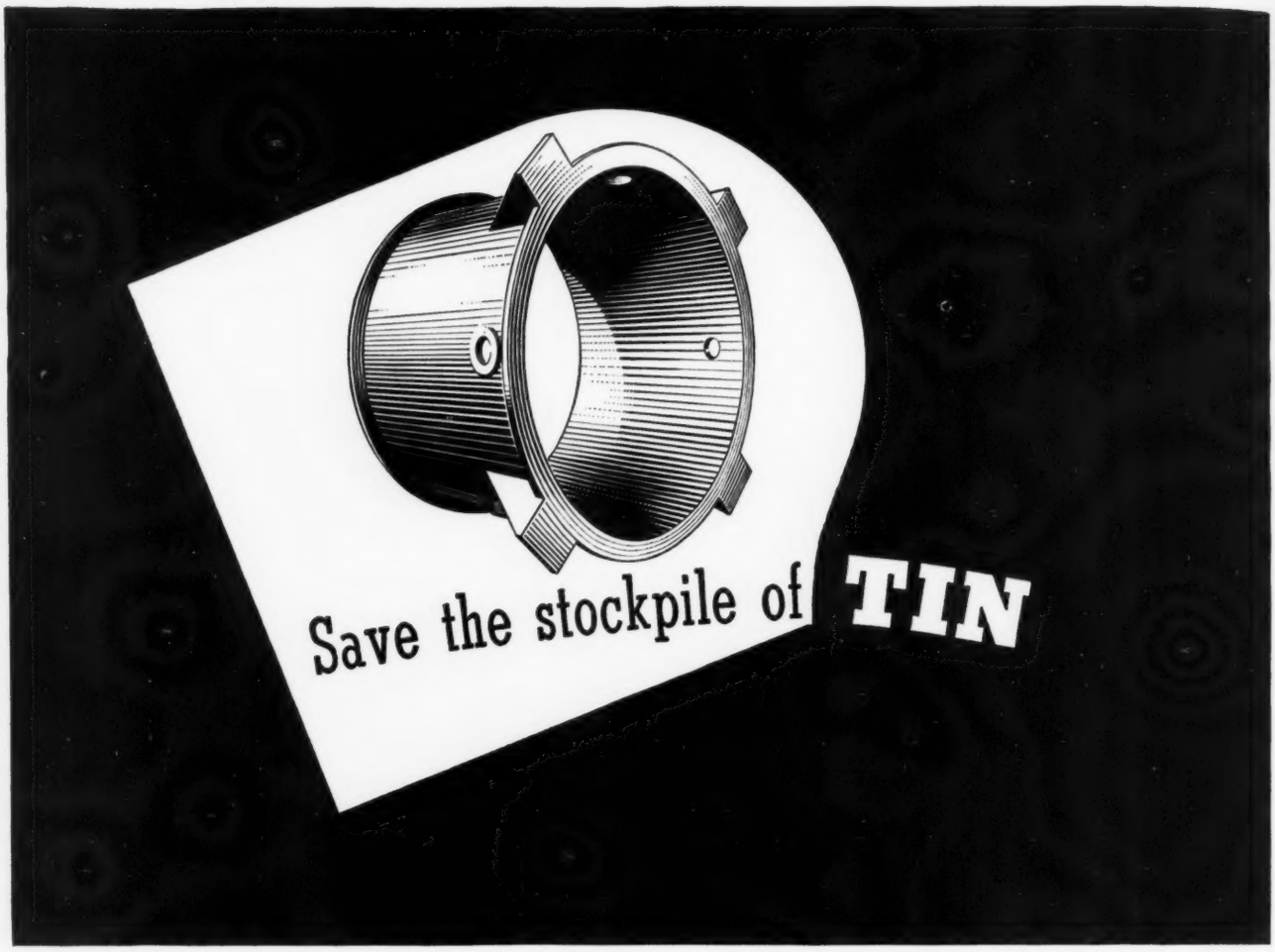
Unretouched photographs of RED CUT SUPERIOR "L" Temper dies used by Rockford Screw Products Company, Rockford, Ill.

A "not uncommon run" with this remarkable steel!

Says the customer

"TOPS IN TOOL STEELS"

STEEL CO. LATROBE, PA.



Use Cramp **P-M-G Metal** to replace tin-bearing bronzes

P-M-G Metal* is a silicon bronze containing *no* tin. In castings it replaces such tin-bearing bronzes as phosphor bronze, gun metal, red brass, and so-called gear bronzes. Compositions "G" and "M" have also been replaced by P-M-G Metal in many applications. The finished product has high physical properties and is superior in many ways.

P-M-G Metal withstands high fluid pressures . . . is successfully used in castings subject to the corrosive and erosive action of sea water, also in many acid installations. P-M-G Metal has higher fatigue value than phosphor bronze or gun metal.

There is more than one grade of P-M-G Metal, each within the limits of Government specifications, thus permitting a wide scope of application. The extensive experience of Cramp engineers can be a valuable guide toward solving your particular replacement problems as Cramp has promoted the use of silicon bronzes for many years. The largest casting of this alloy in America was a Cramp achievement.

Write today stating your change-over requirements. A helpful suggestion will be made promptly as to how you can use castings of P-M-G Metal and thus help conserve the precious tin supply for applications where there is no available substitute.

**Produced under license from Phelps Dodge Copper Products Co.*

PHYSICAL PROPERTIES

CAST P. M. G. METAL

TENSILE STRENGTH (psi)	40,000-55,000
YIELD POINT (psi)	20,000-28,000
ELONGATION (% in 2 in.)	15-23
SPECIFIC GRAVITY	8.44
BRINELL HARDNESS	90-125

CRAMP

BRASS & IRON FOUNDRIES

BLW THE BALDWIN GROUP

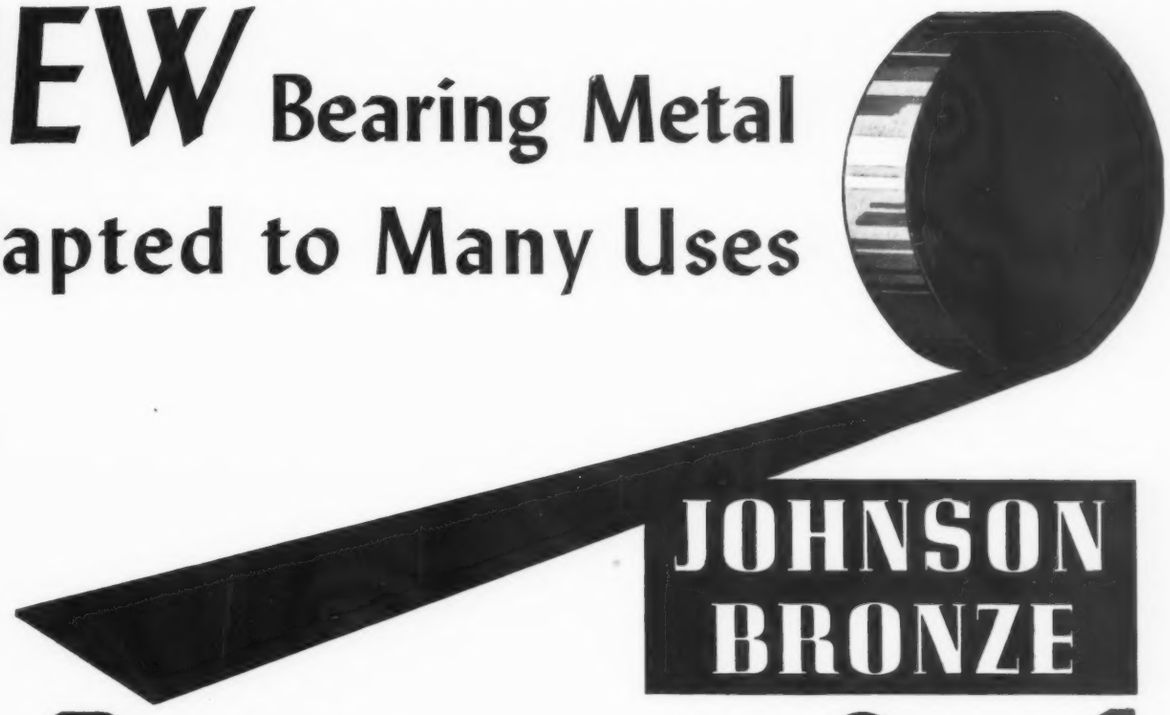
DIVISION OF THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

New York Cleveland

San Francisco New Orleans

NEW Bearing Metal Adapted to Many Uses



JOHNSON BRONZE

Pre-Cast Bearing Bronze on Steel PATENTED

The alloy of the bronze—S. A. E. 64 combines all of the necessary elements to insure outstanding bearing performance in practically any application.

Washers, flat pieces or shapes can be produced exactly to your specifications. This includes oil holes, grooves, slots, indentations, etc.

Pre-Cast Bearing BRONZE ON STEEL was originally developed for thin wall, sleeve type bearings and bushings. Equipment manufacturers were quick to realize that the combination of the bearing qualities of bronze and the strength of steel enabled them to increase speeds and loads . . . to gain longer life and smoother operation . . . greater resistance to shock and to wear. Millions of BRONZE ON STEEL bearings in constant operation prove this point.

Manufacturers are now finding many additional applications for *Pre-Cast Bearing* BRONZE ON STEEL. It is an ideal metal for washers, stampings or other flat pieces such as guide strips on presses and shapers, door slides, brakes, etc. For such applications, we can furnish BRONZE ON STEEL in rolls up to 400 feet in length or as flat strips either plain or graphited. The maximum width is 5½ inches with their thickness, 1/32", 1/16", 3/32". BRONZE ON STEEL is an ideal substitute for rolled bronze. Write today for the complete story on BRONZE ON STEEL. It's FREE.

The most complete SLEEVE BEARING SERVICE in the world

JOHNSON BRONZE COMPANY

Sleeve BEARING HEADQUARTERS

520 SOUTH MILL STREET • NEW CASTLE, PA.

How to Simplify YOUR PROBLEM OF SEPARATING TOOL STEEL SCRAP

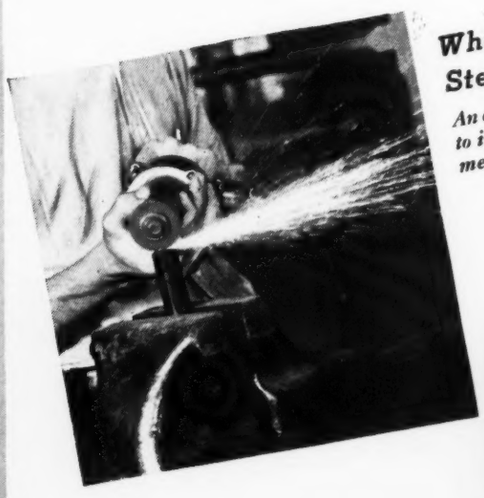
Get in the Scrap
FOR VICTORY

THE easiest, most economical and most satisfactory way of meeting this part of the salvage problem is to keep scrap from getting mixed in the first place. There is no substitute for orderly methods of scrap accumulation and collection. By the simple method of placing ordinary wood boxes in proper places about the plant, and plainly labeling each box for the type of scrap it is to receive, you can prevent many of the headaches arising from mixed scrap. To make this method effective, rules must, of course, be established throughout the plant, so that all men will cooperate.

If, in spite of all your precautions, mix-ups do occur, one method that can help out in quickly identifying an unknown piece of steel, is *Spark Testing.* By simply holding the steel against an emery wheel and watching the color of the lines and bursts, and the character of the spark stream, you get a quick indication of the major elements present—such as carbon, tungsten, molybdenum, nickel, chromium, manganese and silicon. *Spark Testing,* by thus indicating the type of steel, can aid in separating mixed scrap for salvage. However, if for any reason you must be absolutely certain of the alloys present in a piece of steel, the only safe way is to get a complete chemical analysis. The spark test does not *analyze* the steel—it *indicates the type,* and checks on the identity. To find out more about *Spark Testing,* write for the new Wall Chart offered on the opposite page.

Scrap Salvage Hints

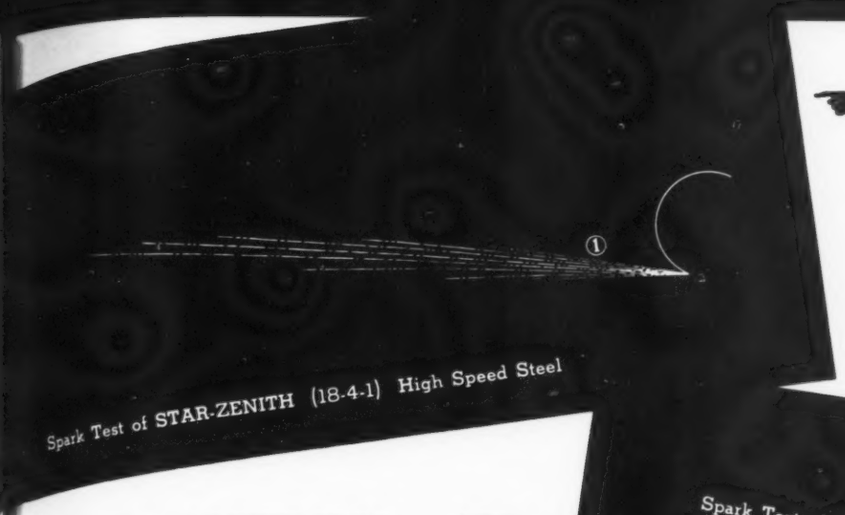
- Make one executive responsible for all scrap salvage. It helps to get *results.*
- Explore odd corners of the plant and get rid of old parts and pieces of steel, obsolete tools and worn-out machine parts. Start them on their way back to usefulness in the *war program,* via the scrap route.
- The best way to salvage scrap is to eliminate it before it occurs. Check your layouts on jobs formed from strip—save steel by more economical layouts. Check your tools, dies and lubricants—save steel by the set-up that reduces rejects to a minimum.
- A lot of plants are saving steel and reducing scrap loss in the tool room by using Carpenter Matched Tool Steels. Tough Timber and Acid Disc Inspection help assure uniform behavior in hardening, less tool breakage and maximum output in service.



What Type Tool Steel Is It?

An emery wheel will help to indicate the answer by means of the spark.

The Standard Tool Steels of Industry



Spark Test of STAR-ZENITH (18-4-1) High Speed Steel

This is a typical "high speed steel" spark.

The stream is very scant—the carrier lines are disjointed (1), relatively short, and reddish-orange in color.

Occasional ghost-like secondary carrier lines are present.

Carbon bursts are absent.

Spark Test of SPEED-STAR Moly Tungsten High Speed Steel

Speed-Star differs from Star-Zenith in the following ways:

The spark stream is fuller, having more and heavier carrier lines (1) a shade lighter in color, and varying in length and thickness.

Thicker lines are continuous and gradually swell into bright orange tongues (2) having slight upward or downward curvatures.

There is a tendency for some ghostlike lines to be carried around the periphery of the grinding wheel. A few sprigs (3) and an occasional suppressed burst (4) are visible.

To help your men become familiar with Spark Testing

Here is a convenient, new Spark Testing Chart prepared by our own testing department. It is designed to assist your men in getting started on Spark Testing. Ten different spark diagrams exactly the same size as those above, are shown on the Chart. These diagrams indicate the spark characteristics that identify each Carpenter Matched Tool Steel (including High Speed). With the Chart as a guide, the study of Spark Testing is greatly simplified and men can readily become familiar with this method of steel identification. Not only is it helpful in separating mixed scrap, but Spark Testing is also valuable in identifying pieces of tool steel that have become mixed in stock. A note on your company letterhead will bring you one of these Carpenter Spark Testing Charts made up in the form of a large Wall Chart 21" x 30" in size—showing at a glance the identifying *pattern* of the spark streams.

THE CARPENTER STEEL COMPANY
105 BERN ST. • READING, PA.

Effects of Various Elements on Sparks

Spark characteristics of the following elements are clearly defined on the chart offered below:

CARBON MANGANESE SILICON
CHROMIUM NICKEL TUNGSTEN
MOLYBDENUM

Instructions are also given for Spark Testing; wheel speeds, effect of wheel grain size, dressing the wheel, etc.

TOOL ROOMS:
This is something that Tool Rooms have long been wanting—a quick reference guide for training men to become more expert in Spark Testing. The tool maker who knows sparks will never waste time or material by making tools from the wrong steels. Send today for this new Tool Room help.

Carpenter MATCHED TOOL STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Information about alloys...

GEARED

to industry's war needs

Converted to wartime tasks, American industry requires and calls upon us for information about alloys. Quickly available are practical answers to your questions about the selection, fabrication and uses of ferrous and non-ferrous materials containing Nickel. • Even before World War I, this Company pioneered studies of special alloys that provide added strength, toughness and wear-resistance. Our years of experience have been digested into printed reports and data sheets that help you save time and material. • Now, with all Nickel allocated where it may best speed Victory, our studies of alternative materials and processes become especially useful. • Upon request, personal assistance from our technical staff supplements the data in our printed bulletins.

NICKEL

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

Assured by Fast, Thorough OAKITE DEGREASING

Only the complete removal of ALL smut, oil, grease and dirt from metal parts . . . whether of iron, steel, aluminum, brass, zinc, cadmium or copper . . . provides the indispensable CHEMICALLY CLEAN surfaces that assure uniformity and proper adherence of corrosion-resistant BLACK FINISHES.

OAKITE DEGREASING HELPS KEEP PRODUCTION UP . . . REJECTS DOWN!

Effective, fast-working Oakite materials, specially designed for preparing surfaces for BLACK FINISHES on war supply items, will give you the satisfactory results you want, help you keep production moving smoothly . . . and do it on a low-cost basis.

ARE YOU MAKING ANY OF THESE WAR PRODUCTS?

If you are making gun or airplane parts, automotive parts, instruments, bearings, gears, tools or other war products and are having trouble in applying BLACK FINISHES, let us give you the benefit of our experience in this work. Write today . . . no obligation.

Manufactured only by
OAKITE PRODUCTS, INC., 26 Thames Street, NEW YORK, N. Y.
Representatives in All Principal Cities of the U. S. and Canada

OAKITE MATERIALS . . . METHODS . . . SERVICE — Specialized — **CLEANING** FOR EVERY CLEANING REQUIREMENT

Are You Taking

SURFACE CUTTING SPEEDS FOR VARIOUS GRADES OF COLD DRAWN CARBON STEEL ON AUTOMATIC SCREW MACHINES

Speeds given below are approximate and are to be used only as a basis from which proper speeds for the part in hand may be calculated. These figures represent averages for the general run of parts made from cold drawn steel. Any extraordinary features in the part to be made should be taken into consideration and the speeds altered accordingly.

A.I.S.I. Number	Present S.A.E. Number	Former S.A.E. Number	Surface Feet Per Minute	% Relative Speed Based on A.I.S.I. B1112 (S.A.E. 1112)
C1006	.....	.....	110	66
C1008	1008	.....	110	66
C1010 (light feeds)	1010	1010	120	72
C1012	.....	.....	120	72
C1014	.....	.....	120	72
C1015	1015	1015	120	72
C1016	1016	X1015	130	78
C1017	.....	.....	120	72
C1018	.....	.....	130	78
C1019	.....	.....	130	78
C1020	1020	1020	120	72
C1021	.....	.....	120	72
C1022	1022	X1020	130	78
C1023	.....	.....	125	76
C1024	1024	.....	120	72
C1025	1025	1025	120	72
C1026	.....	.....	120	72
C1029 (light feeds)	.....	.....	120	72
C1030	1030	1030	115	70
C1033	.....	.....	115	70
C1035	1035	1035	115	70
C1036	1036	.....	105	64
C1040	1040	1040	105	64
C1042	.....	.....	105	64
C1043	.....	.....	105	64
C1045	1045	1045	95	57
C1045 Annealed	1045	1045	120	72
C1050	1050	1050	90	54
C1050 Annealed	1050	1050	115	70
C1052 Annealed	1052	.....	85	51
C1055 Annealed	1055	1055	85	51
C1060 Annealed	1060	1060	85	51
C1061 Annealed	.....	.....	85	51
C1064 Annealed	.....	.....	80	49
C1066 Annealed	1066	X1065	80	49
C1068 Annealed	.....	.....	80	49
C1070 Annealed	1070	1070	80	49
C1074 Annealed	.....	.....	75	45
C1078 Annealed	.....	.....	75	45
C1080 Annealed	1080	1080	70	42
C1085 Annealed	1085	1085	70	42
C1086 Annealed	.....	.....	70	42
C1095 Annealed	1095	1095	70	42
B1008	.....	.....	130	78
B1011	.....	.....	130	78
FREE CUTTING STEELS				
C1109	.....	.....	135	82
C1110	.....	.....	135	82
C1112	.....	.....	135	82
C1113	.....	.....	155	94
C1115	1115	1115	135	82
C1116	.....	.....	155	94
C1117	1117	X1314	140	85
C1118	1118	X1315	140	85
C1120	.....	.....	135	82
C1121	.....	.....	135	82
C1122	.....	.....	135	82
C1132	1132	X1330	125	76
C1137	1137	X1335	120	72
C1141	1141	X1340	115	70
C1144	.....	.....	120	72
C1217	.....	.....	140	85
B1110	.....	.....	140	85
B1111	1111	.....	155	94
B1112 (Union Free Cut)	1112	1112	165	100
B1113 (Union Supercut)	1113	X1112	225	136

REPUBLIC STEEL — PRODUCTION FOR VICTORY

REPUBLIC

FULL ADVANTAGE

OF THE

Uniform Machinability

OF UNION COLD DRAWN STEELS?

With wartime demands for mass production of duplicate steel parts becoming greater and more urgent day by day, every facility and every opportunity for increasing output must be utilized to the utmost.

You steel parts manufacturers are working wonders in production.

And we at Union Drawn will continue to do everything within our power to help you do the job.

The uniform machinability of Union Cold Drawn Steels—the outstanding feature of these steels for more than half a century—is being steadily maintained. The unvarying cutting qualities, the uniform structure, the freedom from tool-wearing abrasives and the smooth finish after machining are today equal to or better than those of last year or preceding years. Hence you can depend upon these steels to help you maintain consistently high production efficiency and quality of finished parts. Physical properties and heat treating qualities are being maintained at their high levels, too.

Are you taking full advantages of this uniform machinability in stepping up and holding an increased rate of production?

To help you establish the most efficient rate of output, and to provide you with a handy reference for comparing steels by their various designations and machinability, we present the table of surface-cutting speeds for various grades of cold drawn carbon steel shown on the opposite page.

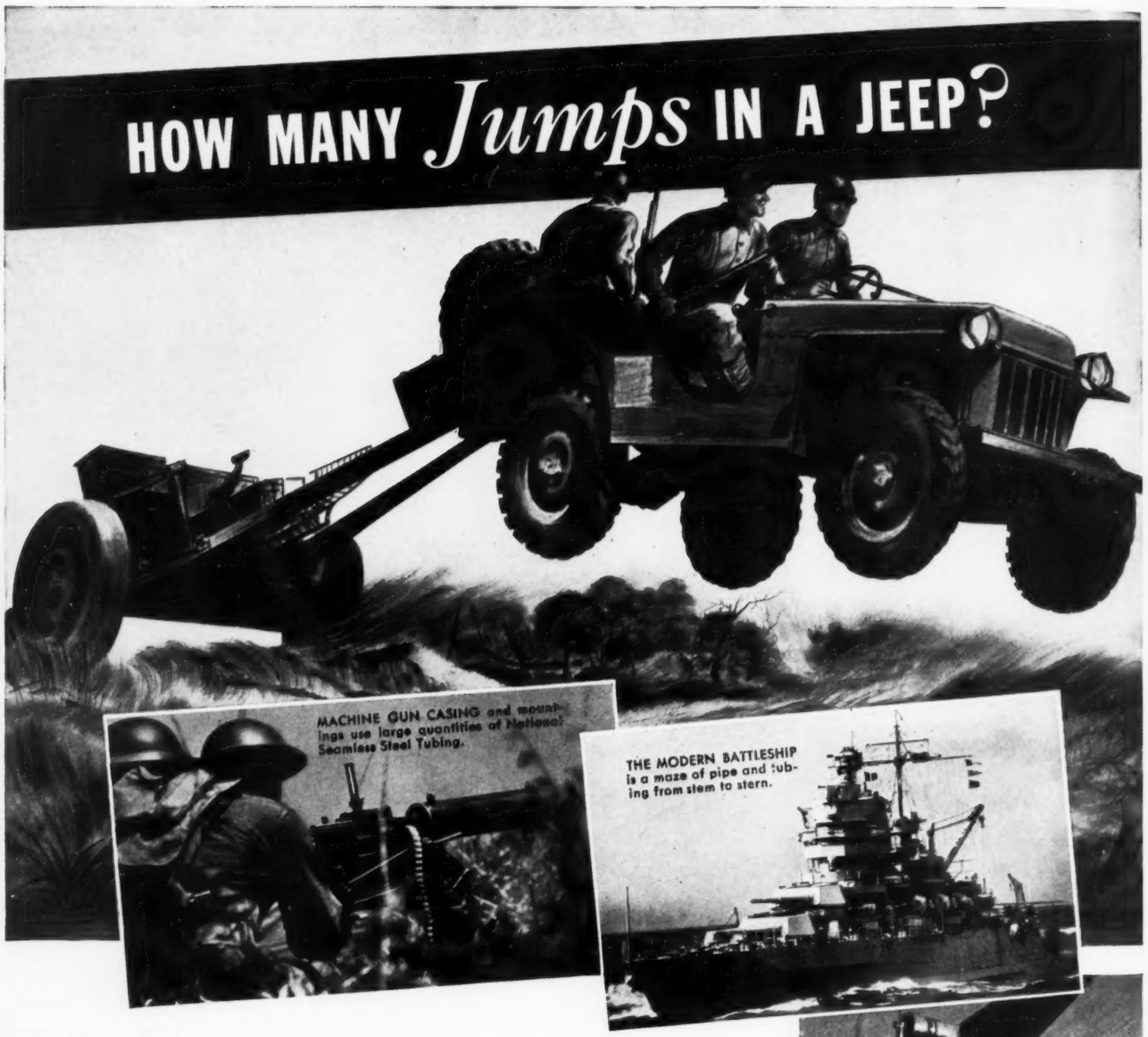
While our most important job today would seem to be the production of every possible pound of the most machinable steel in needed analyses, we continue to feel an equal responsibility in assisting steel parts producers to obtain the highest rate of production of perfect parts from that steel at the lowest cost. If some particular problem concerning the use or performance of Union Cold Drawn Steel is bothering you, tell us about it. We want to help you find the answer—*quickly*.

UNION DRAWN STEEL DIVISION
REPUBLIC STEEL CORPORATION
MASSILLON • OHIO

Berger Manufacturing Division • Niles Steel Products Division
Steel and Tubes Division • Culvert Division • Truscon Steel Company
Export Department: Chrysler Building, New York, New York

Union Cold Drawn Steels

HOW MANY *Jumps* IN A JEEP?



THAT'S what the Army wanted to know. These little cars must take terrific punishment — jumping ditches, striking rocks, and crashing through underbrush.

Army engineers wanted to make sure that the jeeps wouldn't make their last jumps in the middle of a critical battle. So, they put them through a series of field tests in the roughest country they could find.

The jeeps were driven to destruction—the only true test of stamina. When stronger parts were needed, improvements were promptly made. Design engineers solved this problem.

Seamless steel tubing plays an important role in vital parts of jeeps. For its weight, tubing is the strongest structural shape known. It enables the jeep to absorb shocks that would wreck an ordinary car.

Seamless tubing is also being used in tanks, gun mountings, airplane landing gear and many other parts used in war equipment.

We are glad to be able to contribute manufacturing facilities and metallurgical experience that is helping to make American equipment the most reliable in the world.

SHELLS AND BOMBS by the millions are made of seamless tubes. This process is one of the fastest ever devised for mass production of munitions.

WALLS WITHOUT WELDS

"KEEP 'EM JUMP'N"

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

PRODUCE STILL MORE
get 20% greater tool efficiency with

MO-MAX

TRADE MARK REG. U.S. PAT. OFF.

MOLYBDENUM TUNGSTEN HIGH SPEED STEEL

Milling cartridge clearance slot in machine gun. On jobs such as this, MO-MAX is the logical choice.

MO-MAX makes possible maximum conservation of vital alloys.

1 It contains *less than two percent of tungsten.* This amount is being produced in this country or is available from existing high speed steel scrap.

2 It contains only *one percent* of vanadium—a critical alloy.

3 Molybdenum is produced in large quantities within our borders.

4 A chromium content of 3.50 to 4.00% is satisfactory—thus a minimum of chromium is required.

5 MO-MAX has a nine-year record of proved performance, and can be obtained from fourteen leading steel manufacturers.

For Technical Data Booklet!

Write any of the steel makers listed or to The Cleveland Twist Drill Co., Cleveland, Ohio.

LMW . . . Alleghany Ludlum Steel Company
MOHICAN . . . Atlas Steels, Ltd.
BETHLEHEM HM . . . Bethlehem Steel Company
MO-CUT . . . Braeburn Alloy Steel Corporation
STAR MAX . . . Carpenter Steel Company
MOLITE 8 . . . Columbia Tool Steel Company
REX TMO . . . Crucible Steel Company of America
DI-MOL . . . Henry Disston & Sons, Inc.
REX TMO . . . Halcomb Steel Division Crucible Steel Company of America
MOGUL . . . Jessop Steel Company
TATMO . . . Latrobe Electric Steel Company
S.T.M. . . . Simonds Saw and Steel Company
MO-TUNG . . . Universal-Cyclops Steel Corporation
VUL-MO . . . Vulcan Crucible Steel Company

2426

STEEL SCRAP *needed NOW*

TO KEEP WAR MATERIALS MOVING

Iron and steel scrap is used in enormous quantities in making new steel. The steel industry is now in urgent need of scrap to keep the mills operating—to keep war materials moving steadily to American fighting forces and to our Allies.

It is of vital importance to everyone to see that all iron and steel scrap is salvaged now and sent on its way to the mills. Your contribution—much or little—is needed now to secure the total scrap tonnage required to prevent a drop in production.

This appeal is not for ourselves alone. Much of the scrap you contribute will be allocated by the Government to be used wherever it is needed the most.

Salvage Anything Made of Steel or Iron

Manufacturing plants of all kinds are in a position to be of real assistance in relieving the present scrap shortage. Anything made of iron or steel is valuable as scrap—broken or wornout parts of machinery, steel-work from dismantled buildings, old boilers, obsolete dies, pipe. Comb your plant and warehouses for such material.

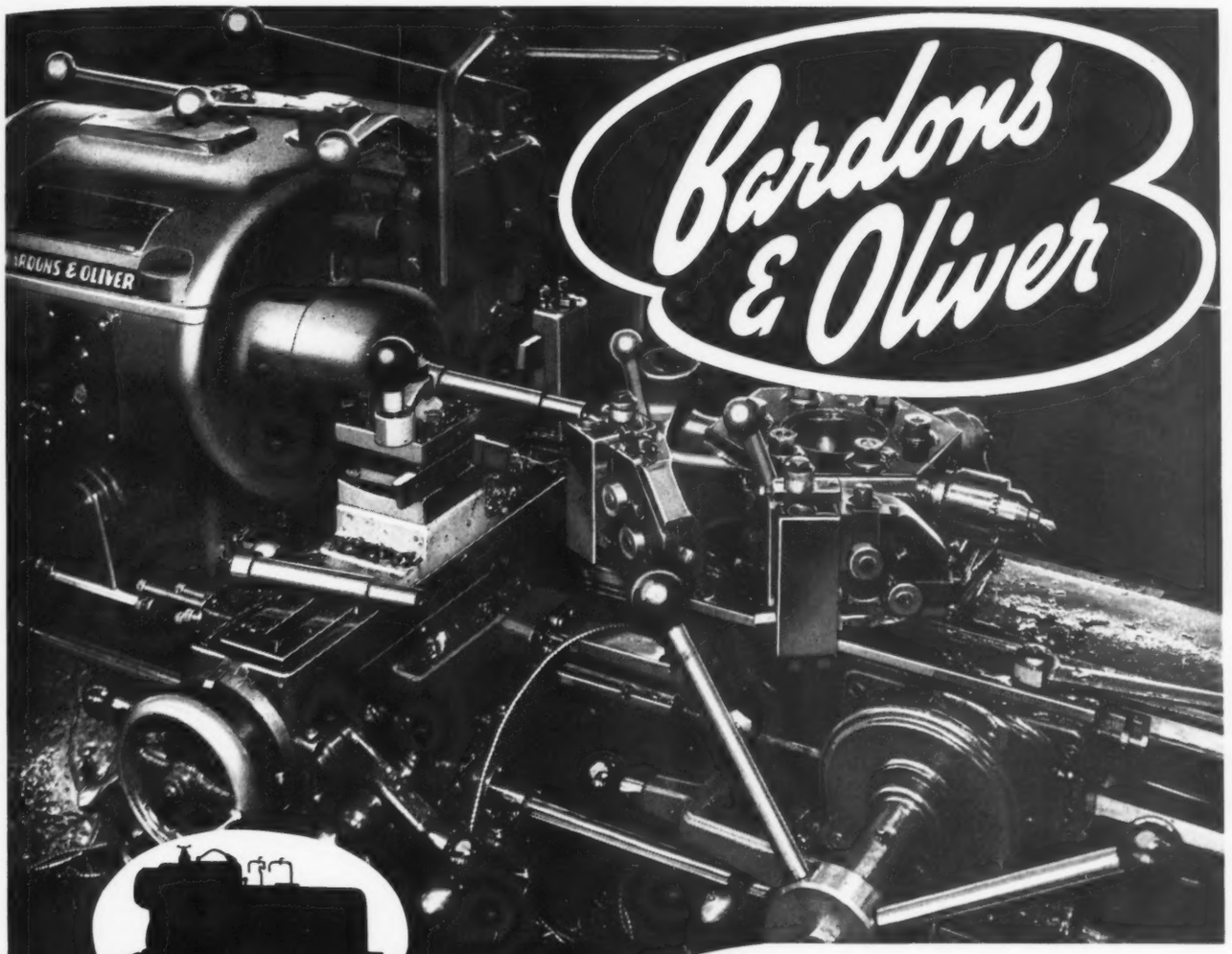
Time is short. The need is urgent. Put your scrap to work for your country—*now!*

WHAT TO DO WITH IT

To get your scrap on its way to the steel mills, sell it to a junk dealer, or get in touch with your local Industrial Salvage Committee. Many organizations have appointed someone to be in charge of salvage—someone who has authority to order the scrapping of material not in actual use, or material which will go out of use in the near future. In this way, available scrap can be located and disposed of most efficiently.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL



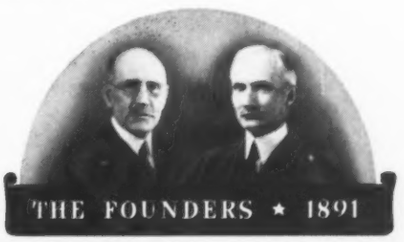
Built to Meet 1942 PRODUCTION DEMANDS!

FAST? The Bardons & Oliver No. 3 Universal Turret Lathe is extremely easy to operate. All control levers can be manipulated conveniently from one control point.

PRODUCTIVE? The powerful drive, together with the sturdy construction makes it easy to take several cuts simultaneously.

FLEXIBLE? The machine is exceptionally well adapted to a large range of variety of bar, chucking, or second operation work.

ACCURATE? Because of the close work tolerances that can be held, this machine is a favorite for work on Airplane parts.



THE FOUNDERS ★ 1891

BARDONS & OLIVER, INC.

1133 W. 9TH ST. . . CLEVELAND, OHIO

Skillful Straightening FASTER

35-ton Hannifin hydraulic press straightening crankshafts. Equipped with long table and heavy-duty center type fixture.

ACCURATE straightening of heavy crankshafts is a job that takes a delicate touch, with some of the touches measured in tons. Rapid production that can be maintained consistently requires simple handling of the work, and simple control of the press, so that the operator's skill can be devoted to the straightening operations.

This Hannifin hydraulic press meets these modern requirements for fast, accurate production. The operator has any ram pressure needed, at a touch of the fingers, from a few pounds to the full capacity of 35 tons. The exclusive Hannifin sensitive pressure control provides complete control of *ram pressures,* infinitely variable in proportion to the amount of control lever movement.

Fast, accurate, easy handling is the natural result of this simple Hannifin pressure control. Its performance contributes to increased production in hundreds of plants building machine tools, aircraft, armament, trucks, and other essential equipment.

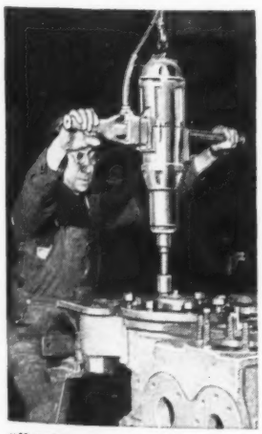
Hannifin standard presses offer many advanced features of design and construction, and may be readily modified to meet individual requirements. For help on any problem of production straightening, forming, press-fit assembly, or similar work involving the application of pressure, write for press bulletin, or consult Hannifin engineers for specific recommendations.

HANNIFIN
MANUFACTURING COMPANY
621-631 S. Kolmar Ave., Chicago, Ill.

HANNIFIN
***Hydraulic* PRESSES**

Gas Mask Production Increased 250%

Speeding Mosquito Boat Production, this workman drills holes for bolting frames to gussetts. The tool is a B & D ¼" Shorty Electric Drill.



"Materially Speeding Production," reports marine equipment maker. "Thanks for help setting up new war-production line. Using B & D Stud-Setters, Nut Runners, Drills, Scruguns. Appreciate prompt repair and parts service."

—with Black & Decker Tools!

THROUGHOUT war industry, Black & Decker Portable Electric Tools are pushing production to new peaks. A time study by a gas mask manufacturer shows: Black & Decker Scruguns cut nut-running time per unit from 15 seconds to a fraction over 4 seconds. Time saving, 73%. Production increase, 250%.

Other busy plants report: "Sheet metal cutting time reduced 75%" . . . "Production up at least 30%" . . . "Screw driving speed increased 20%" . . . Drilling and tapping, screw driving and nut running, sawing and sheet metal cutting, grinding and sanding . . . these are some of the countless jobs on which Black & Decker's many types of Portable Electric Tools are saving precious hours now.

Expert Help—QUICKLY!

A Black & Decker Distributor suggested the time-saving operation shown above. On any tooling problem, and as a dependable source of supply, phone your nearby Black & Decker Distributor. Or write The Black & Decker Mfg. Co., 735 Pennsylvania Ave., Towson, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

CORRECT APPLICATION OF CUTTING FLUID INSURES LONGER TOOL LIFE

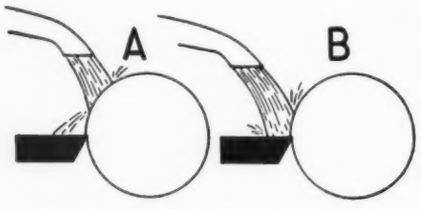
COOLANT IS VITAL FACTOR IN SCREW MACHINE PRODUCTION

The proper selection and application of cutting fluids is perhaps more important today than ever before, because of the faster speeds and feeds used, the use of tough alloy steels in munitions work, the heavy loads on the machines, the 24 hour-a-day operation of the machines, and the absolute necessity for 100% tool cutting efficiency.

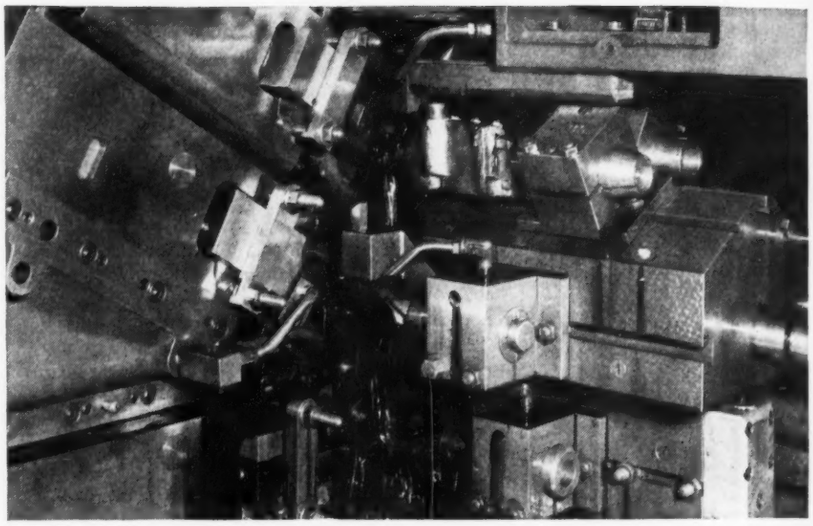
Automatic screw machine users have found that not only is the type of cutting oil used an important factor in obtaining maximum tool life, but that the correct application of the fluid to the tool and work is equally important.

Coolant Must be Applied to Both Tool and Piece

A common fault found in many screw machine departments is that the operator applies the oil only on the work and it is deflected from the tool. Figure A shows how the oil is deflected from the tool when it is incorrectly applied only to the work. Figure B shows how, on the other hand, a correctly applied flow of oil can do an effective job of reaching both the tool and the piece.



When machining at very high speeds, the cutting fluid must be so directed that it will not be carried away from the tool by fast moving chips. This may be accomplished in some cases by piping the coolant from beneath the tool, or by having a flow directed from both sides of the tool.



Here is a set-up view of the Greenlee Six-Spindle Automatic Screw Machine showing a typical application of the cutting fluid for efficient cooling and lubrication of both the tools and piece.

Oil Especially Important In Drilling Work

In drilling work it is important that sufficient oil be applied so as to work its way into the hole. The flow should be directed right into the flute of the drill, and if possible, from both the top and bottom sides of the tool. In this connection, it is well to remember that the coolant pipe should be held as nearly parallel as possible to the drill to prevent deflection of oil from the tool. In deep hole drilling and reaming work, oil drills or oil reamers, with the coolant piped through the tool itself, will give more thorough lubrication of the hole.

When using roller turners make sure that the pipe nozzle is as close to the tool as possible so as to lubricate the rollers as well as the cutting tool and piece.

On threading work it is important that the coolant be run through the die head to wash the chips out of the head.

Proper Temperature Control Adds Hours to Tool Life

The selection of a satisfactory cutting fluid depends upon several factors which may vary from job to job. A careful analysis of each specific job must be made before cutting fluid specifications can be established. The cutting feeds and speeds, the tool hardness, tool shaping, machineability of the metal, and the type of machining operation should all be carefully considered.

Cutting fluids when properly selected and applied will keep the tool cool and prevent it from being heated to a temperature at which hardness and resistance to abrasion are reduced. When temperatures are not properly controlled by coolants, the heat causes the cutting edge of the tool to soften and wear abnormally, which shortens tool life and requires the grinding of excessive stock from the tool when sharpening.

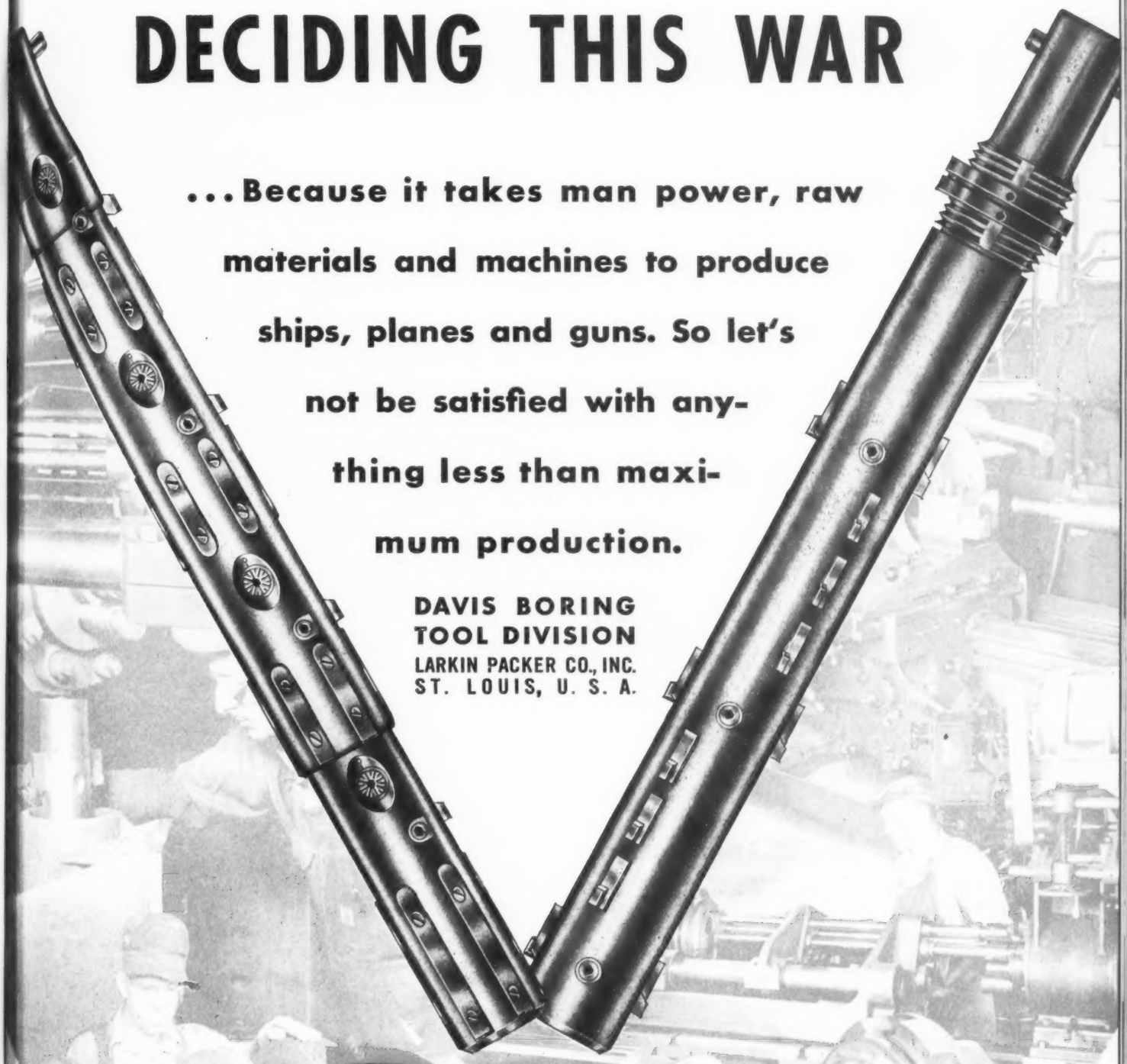
A good cutting fluid will also keep the work cool, preventing it from being machined in a warped shape, it will help provide a better surface finish on the part; it will aid in providing satisfactory chip formation; and it will help wash away chips, particularly in deep hole drilling.

MULTIPLE-SPINDLE DRILLING, BORING AND TAPPING MACHINES

Greenlee BROS. & CO. ROCKFORD ILLINOIS U.S.A.

AUTOMATIC SCREW MACHINES
AIRCRAFT PRODUCTION MACHINERY

YOU AND YOUR TOOLS ARE DECIDING THIS WAR



...Because it takes man power, raw materials and machines to produce ships, planes and guns. So let's not be satisfied with anything less than maximum production.

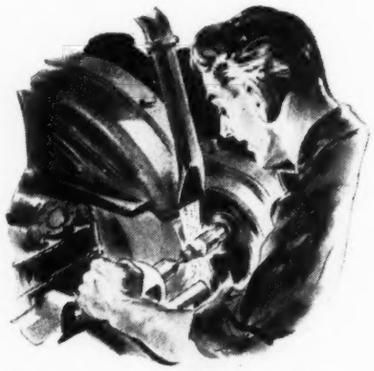
DAVIS BORING TOOL DIVISION
LARKIN PACKER CO., INC.
ST. LOUIS, U. S. A.

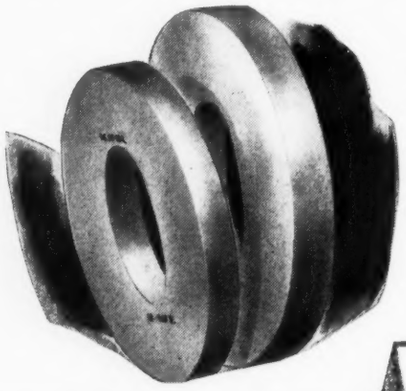
DAVIS
BORING TOOLS

Now they fly ten times as long without overhauling!

The flimsy crates of World War 1 needed overhauling after as little as 24 flying hours. But today's planes fly hundreds of hours at much higher speeds before a major overhaul. The reason? New materials, new designs and new methods of finishing metal surfaces. Finishes so nearly perfect that bearings, cylinders, pistons and cams are made practically wear-proof! It's a process in which Carborundum has played an important part...by supplying the finishing wheels and stones required.

Formerly ultra-finishing was a long tedious task. But thanks to the new process, finishes accurate to a few millionths of an inch can now be produced on ground surfaces on a production basis. Application of these finishes to wartime engine production has improved the fighting efficiency not only of planes, but of tanks and other motorized equipment. Fewer men are needed for maintenance and repair.





Ultra-finishing with extremely fine grit wheels—as fine as 600 grit—is only one of many ways in which Carborundum may be able to help you save precious time. If you have a production problem that abrasives might solve, write The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
REG. U.S. PAT. OFF.
ABRASIVE PRODUCTS

Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company.

HOW TO GET TOOLS THAT LAST LONGER!

AN EXTRA MINUTE WHEN YOU ORDER CAN MEAN EXTRA HOURS OF PRODUCTION

The conservation of tools is an all-important phase of our war effort. Every tool must do more, do it faster—and *last longer!*

To accomplish these things, each tool must be engineered and produced to fit the specific job it is to do. Your tool maker can produce a more efficient, longer lasting tool if he is given *full information* concerning the job.

When writing your orders, take an extra minute to add some helpful data. Tell your tool manufacturer all you can about the job—explain the cutting conditions, state the tolerances and, whenever possible, enclose a print of the part showing the surfaces to be machined. This information will help your tool maker do his job better and will help you get tools that do more and last longer!

ILLINITE

High Speed Production Tools

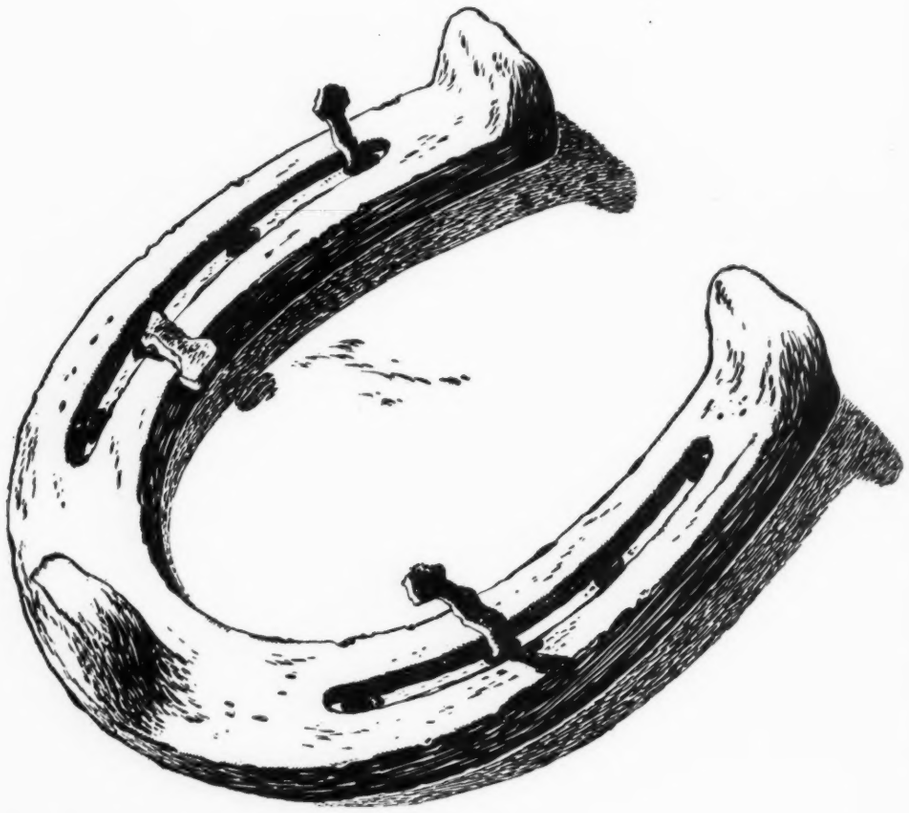
Hobs • Broaches • Shaper Cutters
Milling Cutters
Ground Form Tools • Special Tools

★ ★ ★

Gear Measuring Machines
Gear Measuring Blocks
Die Filing Machines

MANUFACTURERS OF METAL
2501 N. Keeler Avenue, Chicago, Illinois

ILLINOIS TOOL WORKS



LUCK helps...

but you can't run a business on it

The man who always "gets the breaks" isn't lucky, he's progressive. He makes his own luck because he has the initiative to try new ideas, new methods. He realizes today's production winner can be an also-ran tomorrow. The Shell man talks his language.

That's why purchasing and production executives go out of their way to pump our men for new ideas. They have found Shell men to be more than mere sellers of oils and greases.

Have you talked to a Shell man lately about balanced lubrication? He may be able to help you, as he has others, to increased production, longer machine and tool life, improved finish.

SHELL LATA OILS *for Cutting*

SHELL

RUGGED AND FAST!

★

THE FAMOUS
MAXIMILLER
for PRODUCTION NOW!

★

OUTSTANDING IN THE 54-YEAR HISTORY OF

KEMPSMITH

MILLING MACHINES

KEMPSMITH MAXIMILLER

For PRODUCTION *Now* AND IN THE FUTURE —

MAXIMILLERS have what it takes for the grim battle of PRODUCTION NOW in our VICTORY OFFENSIVE . . . because MAXIMILLERS have that surplus of sturdiness needed for heavier cuts (free from dangerous deflection or vibration); increased range of speeds and feeds; more power; longer accuracy; compact design; centralized control; and many other KEMPSMITH advantages. Sizes No. 2, 3, 4 & 5 . . . Vertical and Horizontal (Plain or Universal).

BUILT TO SPEED PRODUCTION ECONOMICALLY ON "3-SHIFT" SCHEDULES

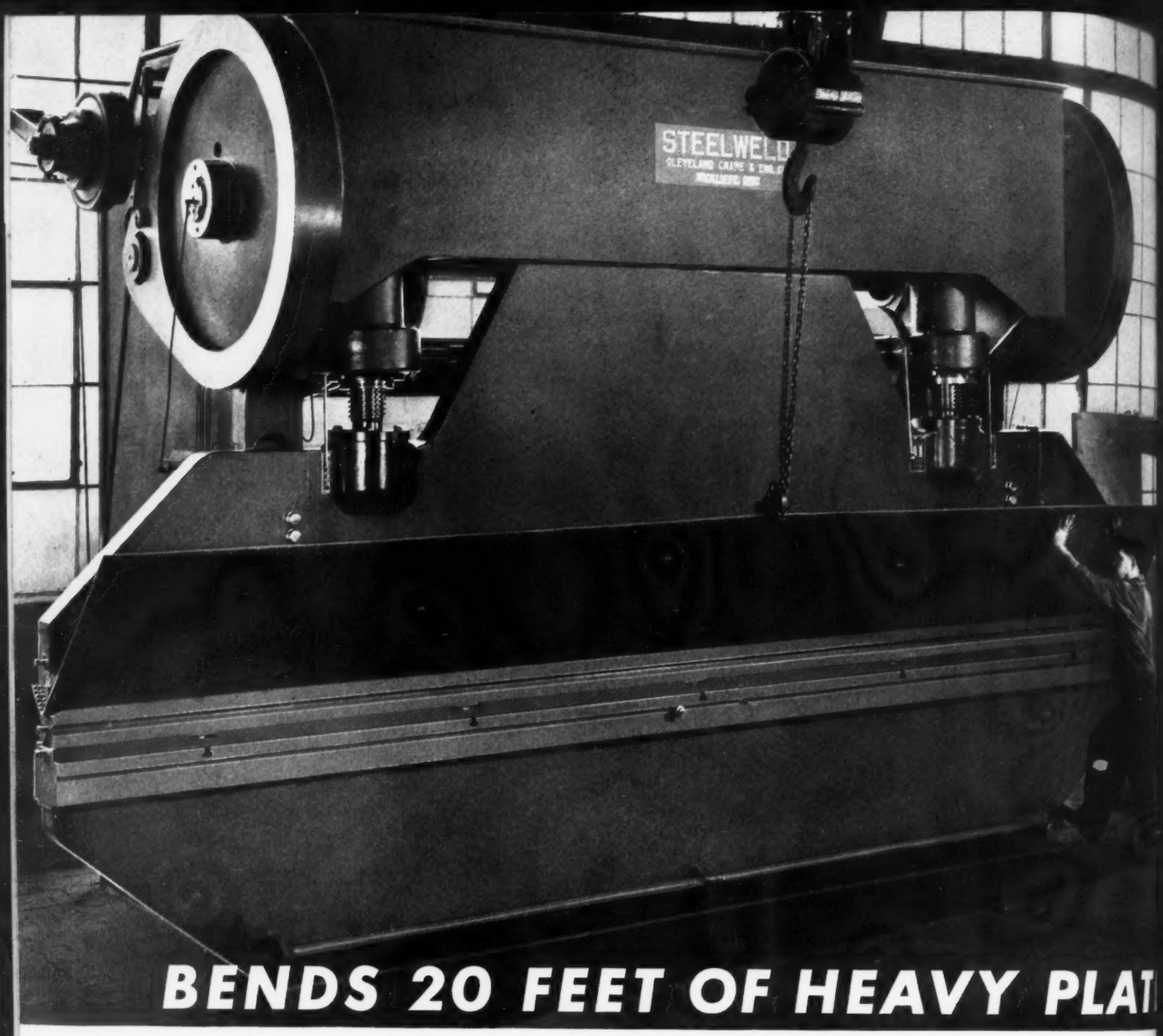
PRECISION

MILLING MACHINERY

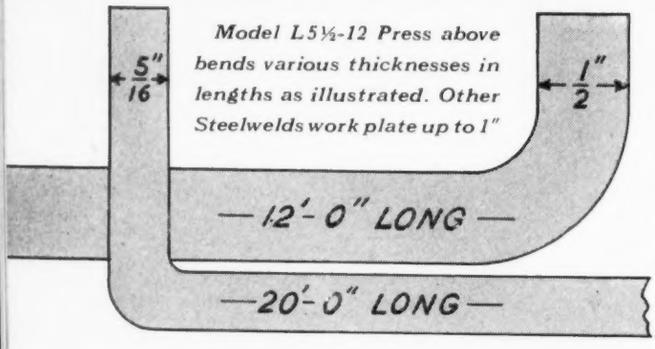
Experience SINCE 1888

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN



BENDS 20 FEET OF HEAVY PLAT



Model L5½-12 Press above bends various thicknesses in lengths as illustrated. Other Steelwelds work plate up to 1"

How long does it take you to weld or rivet two $\frac{5}{16}$" x 20'-0" steel plates together at right angles? How long if you were making a U-shaped or Z-shaped item?

For work of this sort you will find a Steelweld Press a most useful tool. It will cut time and cost to a small fraction. You will save even when you only have occasional odd jobs. For production runs the reduction in time is tremendous. And you will save rivets and angles or welding rod and power too.

Bending is just one of the various types of work you can do on a Steelweld Press.

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

GET THIS BOOK!

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1157 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRES

STEELWELD
BENDING PRESSES

GENERAL SALES AGENTS: CYRIL BATH & CO., E. 70TH & MACHINERY AVE., CLEV

peacetime STANDARDS that became WARTIME ESSENTIALS . . .

"Fafnirs on the controls" has become a byword throughout the aviation industry. Many of the control features that give American-built aircraft the edge in battle today, are the result of Fafnir's peacetime efforts to provide bearings that assured stability, rigidity and the responsiveness that comes with friction freedom. Today Fafnir offers the most complete line of ball bearings for aircraft . . . all types for all duties. You'll find Fafnirs on the controls of Army, Navy and Commercial planes.

Fafnir engineers have gone into every industrial field with the same principles they carried into the aviation industry. Many thousands of users of ball bearings have found in Fafnirs the "turning point" to greater machine operating efficiencies — savings in power transmission — and low-cost, maintenance-free operation. The Fafnir Bearing Company, New Britain, Connecticut.

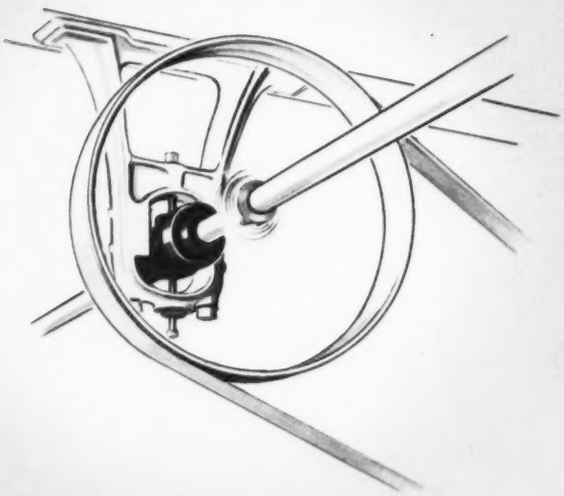
168 HOURS A WEEK

Production has been placed on a "round-the-clock" basis to meet the demands for ball bearings for mechanized equipment, and the machinery to make it. But production of enough "war" bearings is possible only by curtailing the manufacture of certain other types and sizes of bearings. If you are not able to get the type of bearing you have used previously — you will understand why.

FAFNIR
Ball Bearings

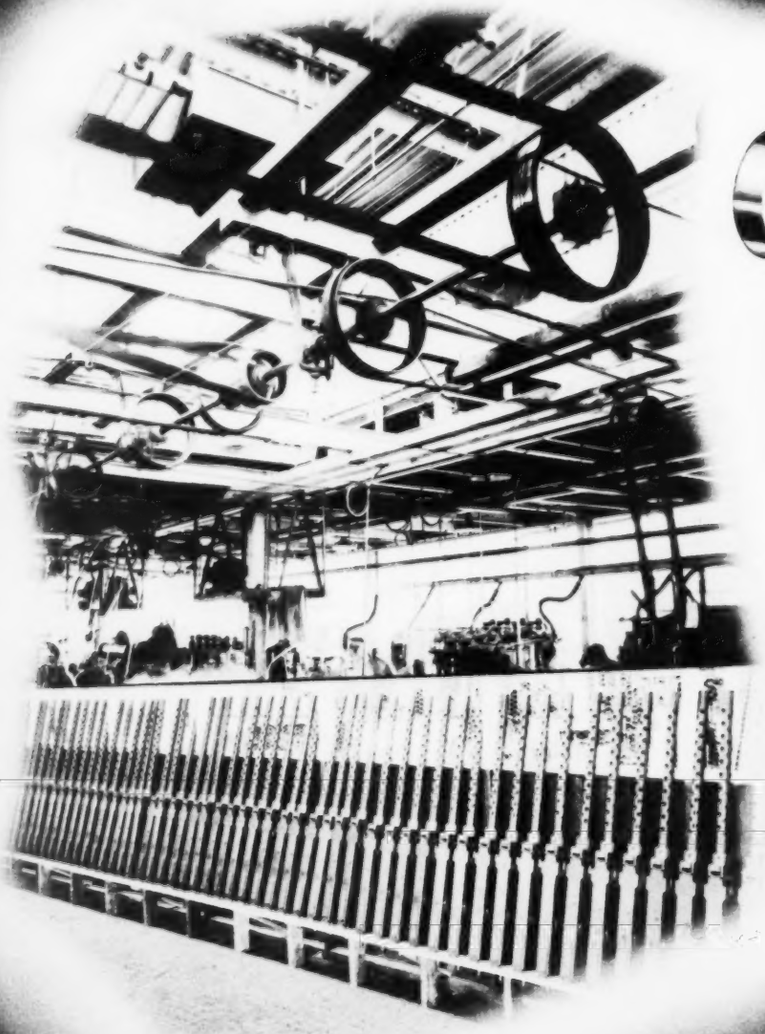
THE BALANCED LINE
FOR ORDNANCE, AIRCRAFT AND
INDUSTRIAL MACHINERY

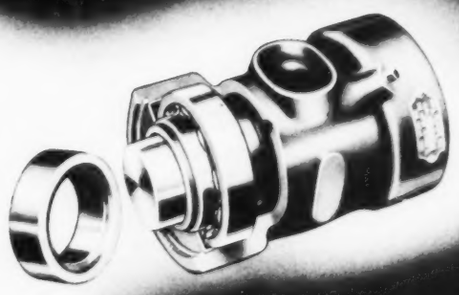
Short Cut to FAST PRODUCTION...



Starting from "scratch" — with old, rebuilt machine tools — a Connecticut manufacturer broke all records getting into production on an order of heavy machine guns. Yankee ingenuity — and easily installed, friction-free Fafnir Double Ball Bearing Hanger Boxes helped him do it!

With motors scarce, individual drives for the machine tools were out of the question. Production couldn't wait. The firm's engineers solved their problems with a unique lineshafting system and quickly installed the Fafnir Hanger Boxes. At the same time, three *other* major problems were automatically solved... machine performance was improved, maintenance reduced, and power was conserved. Fafnirs have been the "answer" to production speed-ups in many war-busy plants. The Fafnir Bearing Company, New Britain, Connecticut.





4 NEW PLANTS

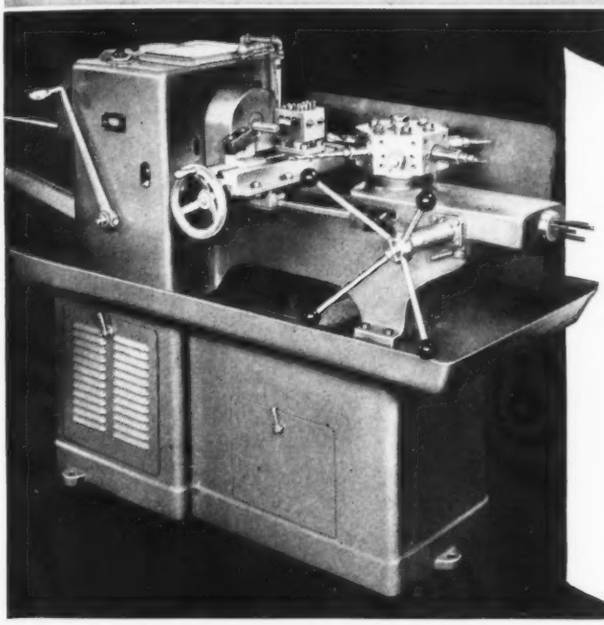
One new plant BUILT, *two new plants* BOUGHT, *one new plant* LEASED . . . *thus has Fafnir tried to keep pace with the tremendous increase in demand for ball bearings for mechanized war equipment and the plants and machines to build it. We hope these expanded facilities will permit us to supply the bearings you need, in the quantities you need, when you need them.*

FAFNIR
Ball Bearings

THE BALANCED LINE
FOR ORDNANCE, AIRCRAFT AND
INDUSTRIAL MACHINERY

BIG ADVANTAGE

OF THE OSTER No. 601 "RAPIDUCTION "LATHE



RELEASES MORE COSTLY MACHINES FOR OTHER WORK

TWO OPTIONAL TYPES OF DRIVE
WORM DRIVE *for smooth flow of power required for making heavy forming cuts with absence of chatter and...*
DIRECT DRIVE *for high speed work on small diameter and non-ferrous metals. Spindle speeds up to 3000 R. P. M. are practical.*

On small diameter work not exceeding 1½" (round bar) 1⅛" (square bar) or 1⅜" (hex bar), the Oster No. 601 "RAPIDUCTION" Lathe is used on a wide variety of bar and chucking operations with efficiencies comparable to more complicated, higher priced machines.

In numerous instances, manufacturers have purchased batteries of the Oster No. 601 "RAPIDUCTION" Lathe chiefly to release their automatics for other work demanding that type of equipment.

Furthermore, the manually controlled, six position turret and the SIMPLIFIED construction and use of the No. 601 "RAPIDUCTION" Lathe speeds up training of new operators, thereby releasing more highly skilled operators for other work.

Complete details describing all the advantages of the No. 601 machine are quickly available. The form below offers you a quick, easy way to ask for this information.

OSTER

Let's GO!

THE OSTER MFG. CO. • 2073 East 61st St., Cleveland, Ohio

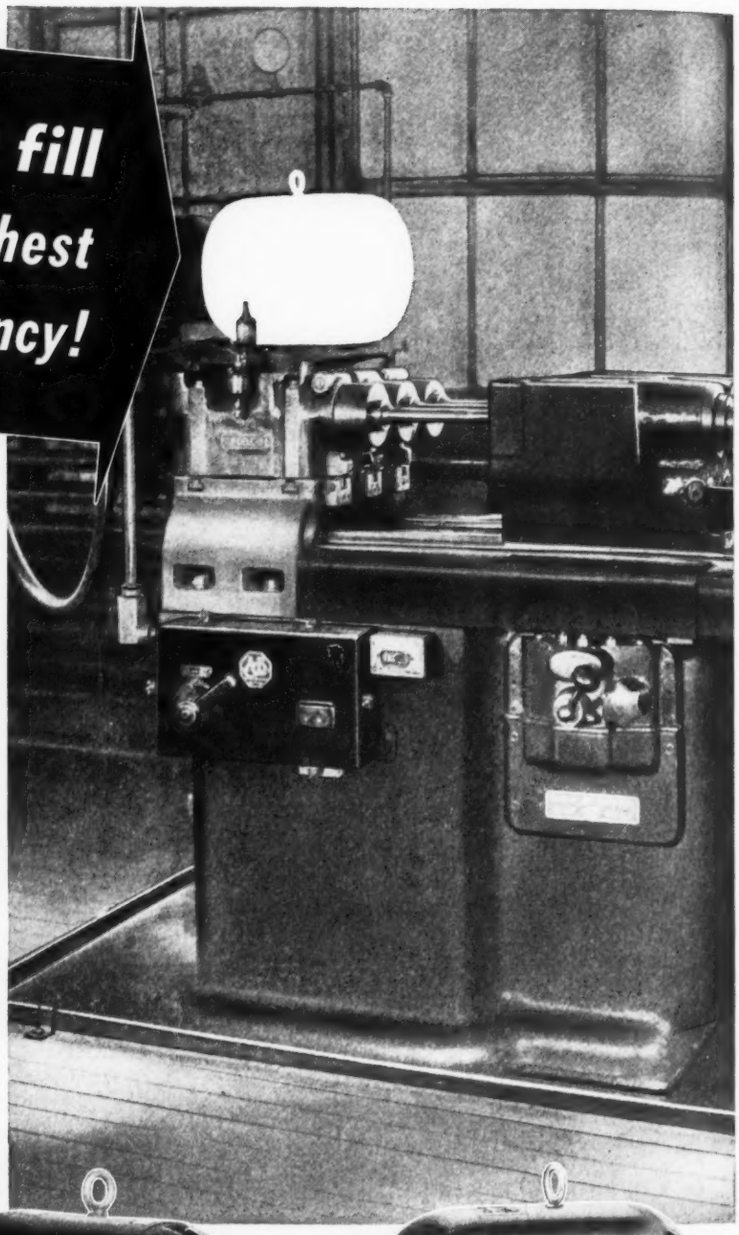
Rush, by return mail ..... copies of Catalog No. 27-A which contains full description and detailed illustrations of No. 601 Turret Lathe.

NAME.....

ADDRESS.....

CITY..... STATE.....

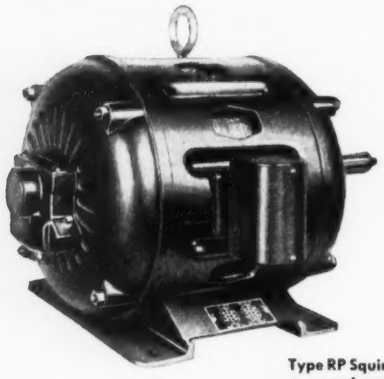
Let Wagner fill this spot... for highest Machine Tool efficiency!



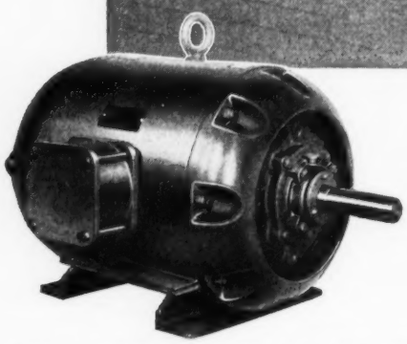
Machine tool efficiency is of vital importance in the present speed-up of production. Motor failure with attendant delay and expensive "out-time" cannot be tolerated in this national emergency.

Your best protection against production delay and unnecessary expense is to use Wagner Motors on all machine tools and other electrically driven equipment. Their long life and absolute dependability make them well-suited for the job.

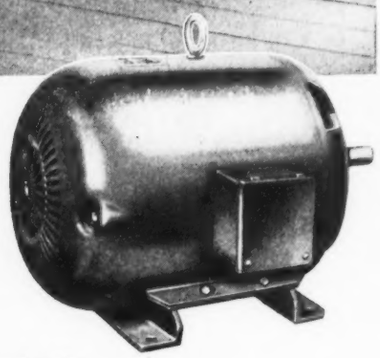
Wagner motors, the first choice during peacetime, can be depended upon to do "double-time" during this crisis. They are available in a variety of electrical types and sizes to take care of all kinds of machine tools. A few of the many Wagner motors are illustrated below. For information on the complete line write for bulletins MU-182 and MU-183, or consult the nearest Wagner branch office. Wagner branches are conveniently located in 25 principal cities. Wagner field-engineers will be glad to help you.



Type RP Squirrel-Cage motors are used on machine tools and other electrically driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycles, 2- or 3-phase.



Type HP motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125-hp, 2- or 3-phase, 25 to 60 cycles.



Type CP totally-enclosed fan-cooled motors are widely used on machine tools where dust, dirt, filings, chips, fumes or other destructive elements are prevalent. 1-1/2 to 125-hp, 25 to 60 cycles, 2- or 3-phase.

Send for copies of **BULLETINS MU-182 and MU-183**

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

SALES & SERVICE BRANCHES IN TWENTY-FIVE PRINCIPAL CITIES ★

M42-16

MOTORS · TRANSFORMERS · FANS · BRAKES

Speed Up GUN BARREL INSPECTION

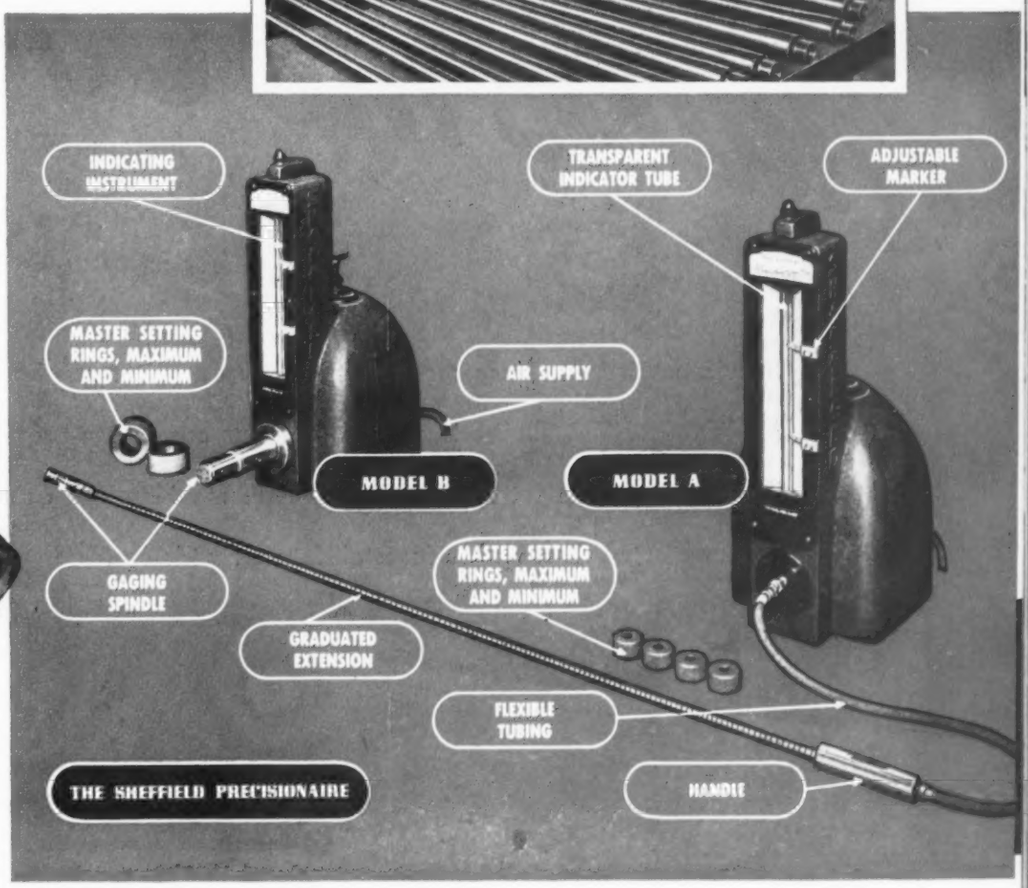
In just one pass through a gun barrel the Sheffield Precisionaire tells the inspector whether or not the bore is within prescribed tolerance or, if not, whether it is oversize, undersize, out-of-round, or bell mouth —also exactly at what point any dimensional discrepancy occurs.

It takes no longer to inspect a gun barrel than it does to push a cleaning rod through it and no more skill, in spite of the fact that the Precisionaire is accurate to .0001". Any new operator having no previous experience can be taught to handle this gage in less than fifteen minutes.

Contrast this speed and this accuracy with inspection by previous methods which were not only slow but which required the highest order of gaging skill in order to maintain accuracy.

The same instrument provided with two slightly different gaging spindles is used to check the bore before rifling and then, by changing the spindle, give it a final inspection after it is rifled.

The Precisionaire, while it is being used extensively for gun barrel inspection, has a number of other very important uses all described in bulletin 42-23. Write for your copy now.



THE *SHEFFIELD* CORPORATION

DAYTON, OHIO, U. S. A.

SHEFFIELD GAGES
MASTER GAGEMAKERS

Do Your Motors Match The Job?

General Electric Co.
Sect. 750-140B; Schenectady, N. Y.
Yes, send me the Motor Fitness Manual, GEA-3873.

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....STATE.....

CITY.....

Motor Fitness Manual

for plants converting or already converted, to war production. Tells what to do to get the most out of motors, old or new. If you're undertaking new work on motor-equipped machines, if you're "switching" motors from one job to another, or equipping machines with new motors—you'll find here helpful facts to save your time. Write for a copy.

MAKE THIS

MOTOR FITNESS TEST

1 WHEN YOU SHIFT a machine to war work, even if there is no real change in the type of work the machine will be doing—

☐*Check motor conditions.* Examine bearings, insulation, wiring connections. Clean the motor thoroughly inside and out.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

2 IF YOU RELOCATE the machine, or change other machines nearby—

☐*Check power supply.*

☐*Check on physical protection of the motor.* If an open motor, particularly one of older design, make sure it is safeguarded against entry of chips, cast-iron dust, excessive coolant.

☐*Recheck alignment and mounting arrangement* to prevent vibration and rapid bearing wear.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

3 WHEN YOU BEGIN the first trial run on new work—

☐*Measure voltage and determine ampere value* under load with a hook-on volt-ammeter or other load-analyzing instrument.

☐*Check motor starting characteristics,* making sure that the motor comes up to speed promptly.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

4 AS YOU PLAN new operating schedules—

☐*Review the motor lubrication and maintenance routine* to be sure it will receive regular attention at intervals in keeping with the new duties.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

5 SHOULD YOU FIND motors now in service inadequate for the job—

☐*Get in touch with your local G-E motor representative,* who will advise you as to whether they should be repaired, rebuilt, or replaced. *Don't wait for motor trouble which may delay production before taking this step.*

AND REMEMBER—If new motors are required to meet present-day conditions, G-E Tri-Clad motors in standard, open construction (1 to 100 hp) are generally available without delay for high-priority war jobs.

BUILDER OF TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

GENERAL ELECTRIC

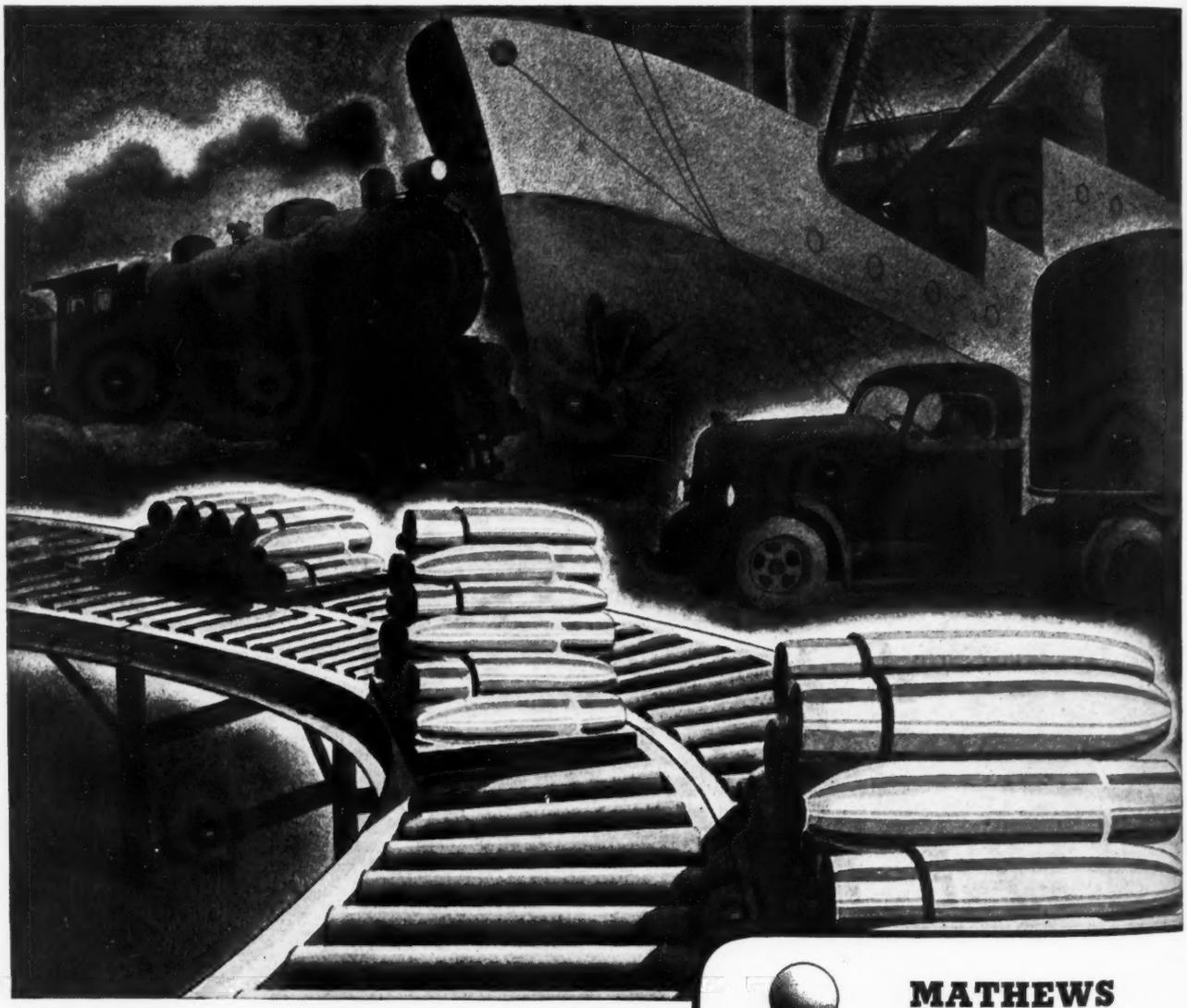
Prime movers

. . FOR AMERICAN WAR PRODUCTION

● The great units of America's transportation system, her trucks and trains, depend heavily upon another transportation system to keep them rolling — the modern conveyer system.

Without conveying equipment to speed materials to and from processing machinery, and into the cars and holds of ships, the transportation of vital war material would slow down considerably. Ships would remain longer in port — carloadings would fall off.

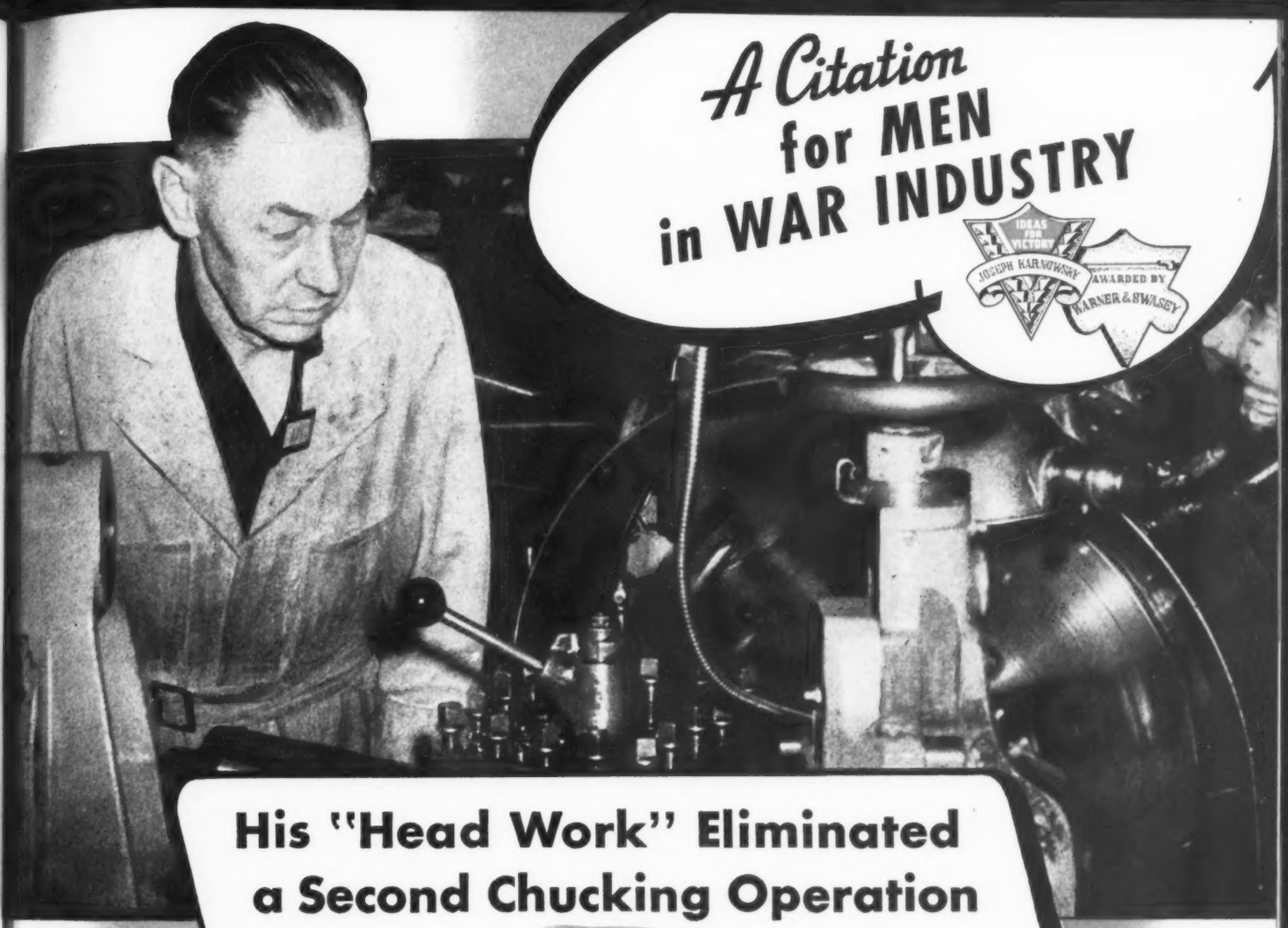
Long Mathews engineering hours are devoted entirely these days to the development of equipment for handling war material so that our prime movers can get it to where it is needed in less time.



If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYER CO.
ELLWOOD CITY, PENNA.

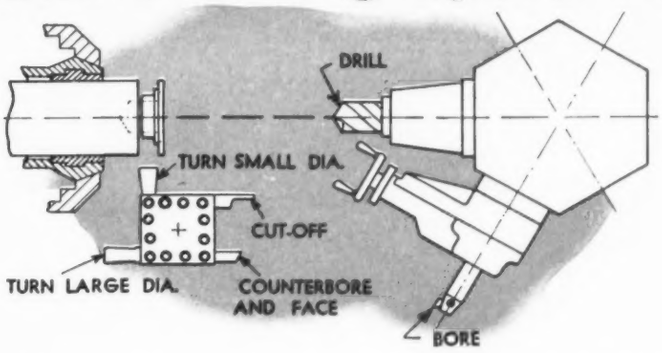
MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION



A Citation for MEN in WAR INDUSTRY

IDEAS FOR VICTORY
JOSEPH KARNOWSKY
AWARDED BY
WARNER & SWASEY

His "Head Work" Eliminated a Second Chucking Operation



Joe Karnowski mans a turret lathe in the Strut Department of *Bendix Aircraft,* South Bend, Ind. Along came a complicated collar job with the routing book calling for two chuckings. But operator Karnowski, like thousands of other skilled mechanics, thinks beyond routine work sheets. By rearranging the tooling, he was able to finish the work in *one* chucking, saving valuable time otherwise spent in rechucking for a second operation. The finished piece is also more accurate because in a single chucking all faces are square and the hole concentric. We are proud to present operator Karnowski with a gold victory pin for his contribution to "Ideas for Victory".

Hundreds of resourceful operators send their "Ideas for Victory" to be published in "Blue Chips", a newsy shop bulletin sent free to turret lathe operators' home addresses. Make sure *your* operators—old timers and learners—are on the list to get "Blue Chips". They'll enjoy it and profit through reading it. Write Warner & Swasey, Cleveland, Ohio.

Ideas for VICTORY

...from the Production Lines behind the Firing Lines...

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

WARNER & SWASEY
Turret Lathes
Cleveland

Lowering a charge of forgings for machine-gun barrels into a Homo Method Furnace, to be low-temperature annealed prior to rough-machining. A typical use of Homo Tempering in the machine-gun plant of John Inglis Co., Limited, one of Canada's mass-production war plants.

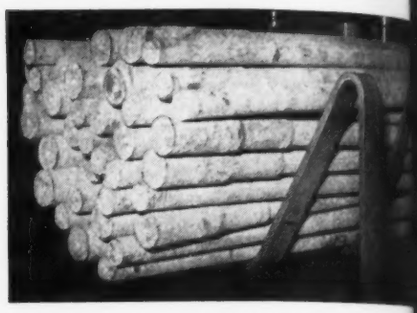
MACHINE-GUN BARRELS

Uniformly Drawn By HOMO Method

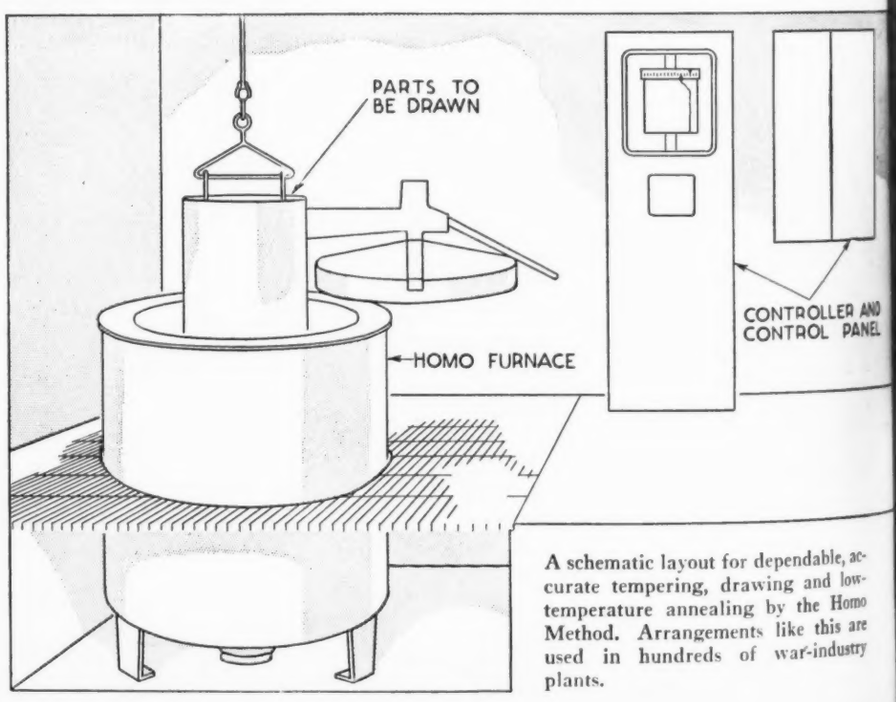
A tough problem in the making of machine guns (as in other war necessities) is to anneal the roughly-forged parts so that hard spots are completely eliminated. The parts must be so uniform in softness that their excess metal can be turned, broached or planed away in absolutely minimum time, with minimum human attention. Here's how John Inglis Co., Limited, giant Canadian munitions makers, are handling this low-temperature anneal of the barrels for tens of thousands of Bren, Browning Colt and Boice guns.

In general, the operating routine is to load the forgings into special fixtures, lower them into Homo Method Tempering Furnaces, set the automatic recording controllers and leave the equipment alone until time to unload. Electric heat, distributed by forced-convection to the exposed surfaces of the barrels, brings them to temperature so uniformly that hardness readings show practically no variations. And, when the rough-machining lathes cut great curling chips of metal from the barrels, and the boring mills and riflers work within them, the forgings go through with every advantage that correct annealing can give.

Many other gun parts go to the Homo not once, but twice—first for low-temperature annealing or for Homo-carburizing, and then to another Homo, for final tempering. For this great Inglis plant got into speedy, all-out production by using the established, dependable, up-to-date methods of industry—methods which include Homo Tempering, Homocarb Carburizing, Homo Nitriding and Vapocarb-Hump Hardening. If you have a problem in heat-treatment, the same methods can probably help you. As a start, we suggest you outline the situation in a letter, or ask for appropriate catalogs—T-625, *Homo Tempering;* T-623, *Homo Carburizing;* T-624, *Homo Nitriding,* T-621; *Vapocarb-Hump Hardening.*



One of the thousands of batches of Homo-annealed rough forgings from which the barrels of machine-guns will be shaped.



A schematic layout for dependable, accurate tempering, drawing and low-temperature annealing by the Homo Method. Arrangements like this are used in hundreds of war-industry plants.

Jrl Ad T-625(27)

LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

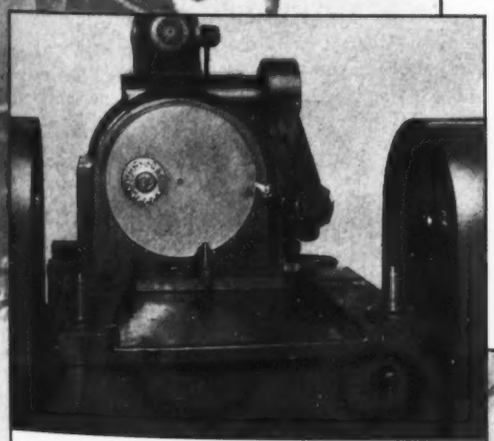
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Conserve Man Power today . . .

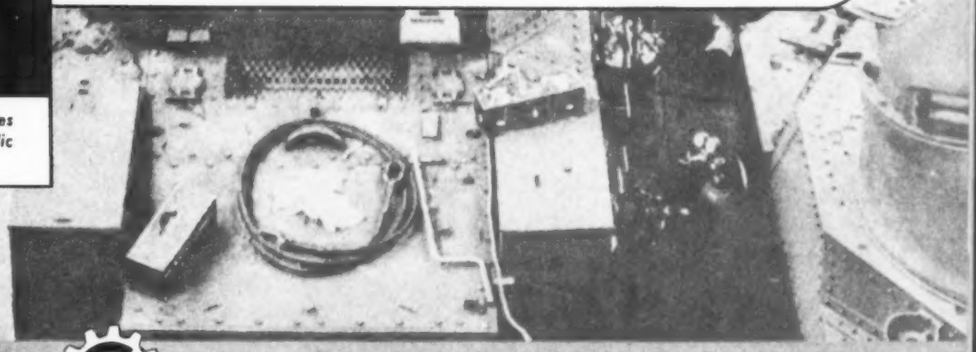
WITH CROSS SPECIAL MACHINES

CROSS 3 WAY *Milling Machine*

Demand for greater volume cannot be satisfied with the lone expedient of additional man hours. Manufacturers who were forced to improvise for a quick start are now increasing production with special machines that consolidate many operations. Cross analyzes manufacturing problems, develops new methods, engineers and produces special machines for doing better work faster. A typical application: the Cross 3-way profile miller which simultaneously finishes three faces on tank transmission housings with improved accuracy and saves 6 man hours per piece.



Cutter spindles are mounted in large circular cradles that oscillate in synchronized relation with hydraulic cross feed of the heads.



GRAPH FROM PRESS ASSOCIATION, INC.

CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

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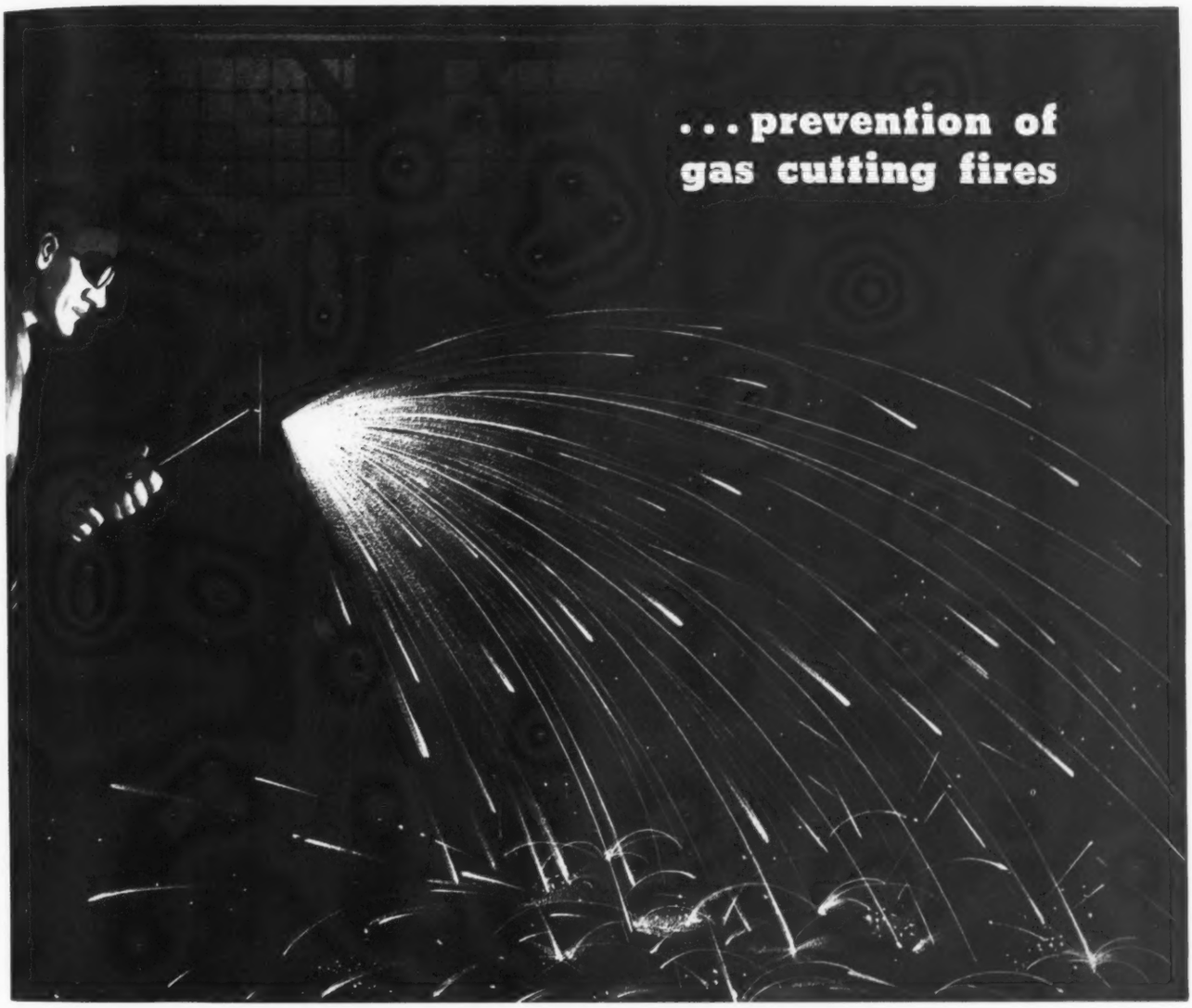


Information supplied by National Fire Protection Association

The surest way of preventing cutting and welding fires is to keep flames, sparks, molten slag and hot metal away from flammable materials. This elementary precaution is the most often ignored.

There are other precautions which, if observed, will do much to prevent cutting fires.

1. Always check fire hazards in new locations before starting work.
2. Have precautions in individual cases specified by responsible authority.
3. Move combustible material at least 30 to 40 feet away from cutting operation.
4. Sweep floors clean before lighting the torch.
5. If combustible material cannot be moved, or if sparks or slag may lodge in wooden structures, or drop through pipes or holes to floor below, use sheet metal guards, asbestos paper or curtains to localize flying sparks or slag.
6. Before cutting steel or iron be sure that it will not drop on combustible material.
7. When finished check surroundings thoroughly to make sure *all* smouldering sparks are put out.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

Even the Ancients had Accuracy

The accuracy of the Ancients in building the mighty pyramid of Cheops at Gizeh was based upon the cubit—length of the forearm from point of elbow to tip of middle finger.

By years of careful and painstaking work, this colossal monument, some 480 feet high and covering 13 acres, was built so closely to dimensions that modern instruments detect no error.

Today we cannot afford to spend years or even days to obtain accuracy. Stepped-up production schedules make standardization and interchangeability paramount in importance. Workers of metal throughout the world now realize that accurate gages are essential in economical and speedy manufacturing processes.

Axelson gages, checked by Bureau of Standards approved masters, are in service everywhere. If you have a gage problem we'll help you solve it.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Axelson Gages

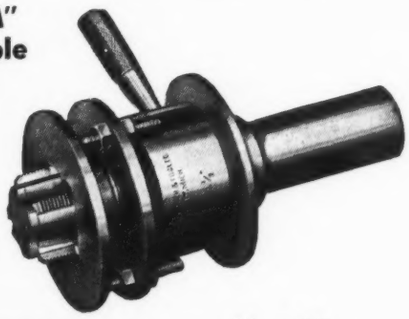
"THE ACME OF ACCURACY"

AXELSON MANUFACTURING COMPANY

6160 Boyle Ave. (P. O. Box 98, Vernon Station), Los Angeles • • • 50 Church St., N. Y. • • • 3844 Walsh St., St. Louis

Good Strategy
FOR WAR PRODUCTION THREADING JOBS

Type "M" Collapsible Tap



No. 32 Thread Milling Machine

Type "CO" Self-Opening Die Head

The planes that bombed Tokio, the ships that won important victories in the Coral Sea and at Midway Island, illustrate the important part that good equipment plays in wartime strategy. Give our men the right tools to work with — and the battle is as good as won!

Use the same strategy in your Battle of Production! Choose Murchey Taps, Die Heads and Threading Machines for the important threading jobs of aircraft and munitions manufacture. Already at work producing a variety of precision aircraft threads, tapping the nose of shells and bombs, threading the base end of anti-aircraft shells and performing similar munitions threading jobs, Murchey Taps, Die Heads and Threading Machines are cutting threads to the highest standards ever demanded in mass production.

Now, when the most work—and the most accurate work—must be obtained from every tool, it's good strategy to choose Murchey Tools . . . for precision, for tool economy and for time savings.

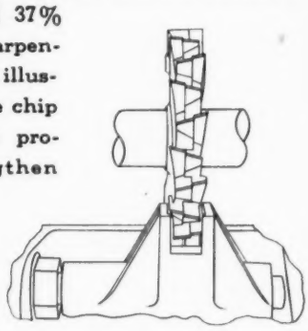
We also manufacture a complete line of Thread Milling Machines and Shell Tapping Machines

MURCHEY
MACHINE & TOOL COMPANY

951 PORTER STREET DETROIT, MICH.

FOR HEAVY SLOTTING..

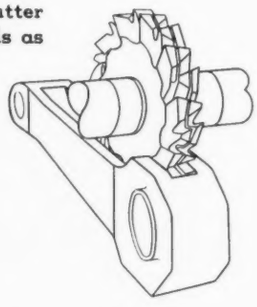
The sketch illustrates an example of deep slotting with a new B-C Interlocking Cutter. The piece is a cast steel transmission fork with a slot 1¼" wide and nearly 1⅞" deep, removing ⅛" on each face. By changing from a herringbone type cutter to the new B-C Interlocking Cutter, production was materially increased with greater feed and speed, and the cutter, in addition, delivered 37% more pieces per sharpening. This is a good illustration of how free chip flow can improve production and lengthen cutter life.



NEW BARBER-COLMAN INTERLOCKING CUTTER

FOR DEEP BLIND CUTS..

This sketch illustrates how a new B-C Interlocking Cutter is successfully used in milling the slots on the master connecting rod of a radial airplane engine. This particular cut goes well into the shoulder of the rod, yet the cutter never hesitates or stalls as the cut gets deeper and heavier. *Free flow of chips* across the teeth permits new B-C Interlocking Cutters to handle jobs that would completely stop the ordinary type of cutter.



ADVANCED design produces an interlocking cutter having the advantages of a staggered-tooth type. On the conventional interlocking side mill, the face edges form a vee which may pocket chips and cause early dulling. Now, with virtually continuous tooth edges, *free flow of chips* across the teeth is obtained, with much longer life for the cutter. Tools of this type are recommended for long deep slotting in steel, and are especially adapted to shoulder cuts. Depth of cut may be taken up to the hub in many cases, without stalling the cutter. For specific recommendations on this patented design and all other types of B-C Milling Cutters, consult your Barber-Colman representative.

BARBER B-C COLMAN
PRODUCTS
MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 203 Loomis Street, Rockford, Illinois, U. S. A.

"MAN-HOURS"

—the misleading measure of production

It requires but one eye to see that man-hours alone are no measure of production. The thing that counts is how much that man can produce in one hour.

ALTER EGO: Sure. By one method he may produce two or three times as much per hour as by another method.

Take arc welding. This method results in far greater effectiveness. In joining steel, one welder does the work of two, three or four men using other methods. And he does a better job with 15% to 25% less steel.

ALTER EGO: Then it would seem a better measure for a company's contribution to the war effort would be METHOD-HOURS.

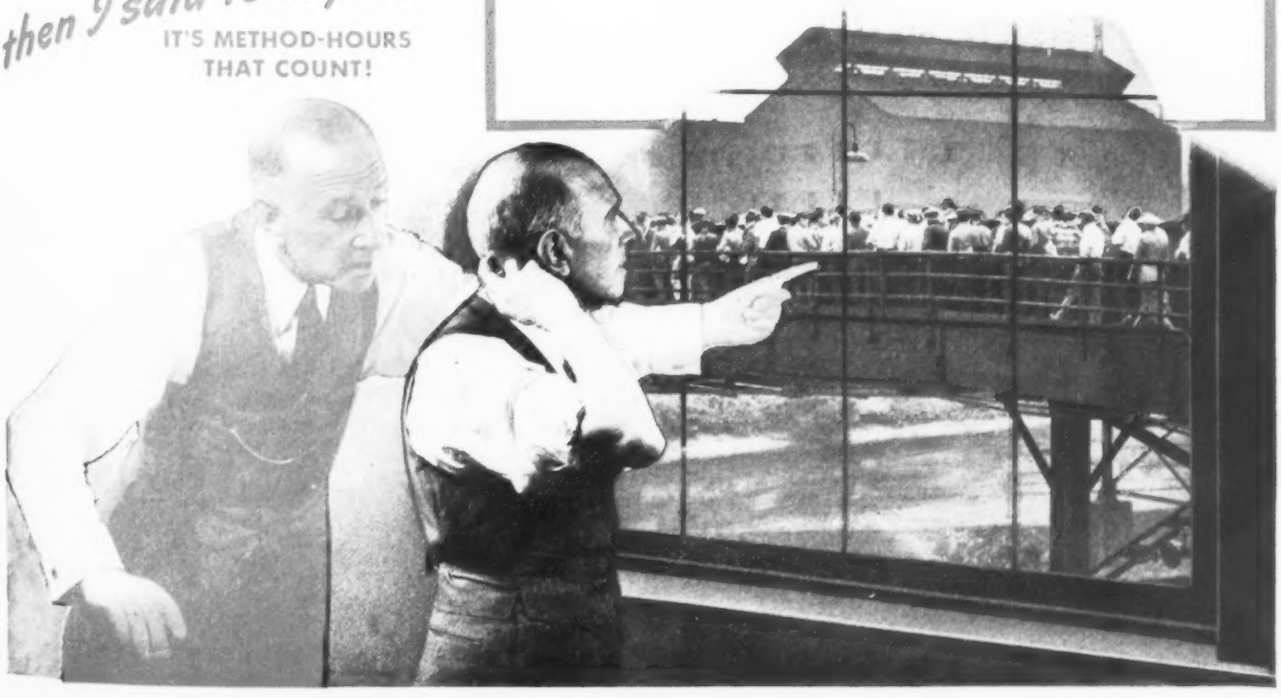
True as gospel. Our whole war production has been zoomed by those who grabbed arc welding as the only way to save our national neck.

ALTER EGO: And later they'll be schooled in an art to save their individual necks when competitive production again seeks profitable markets.

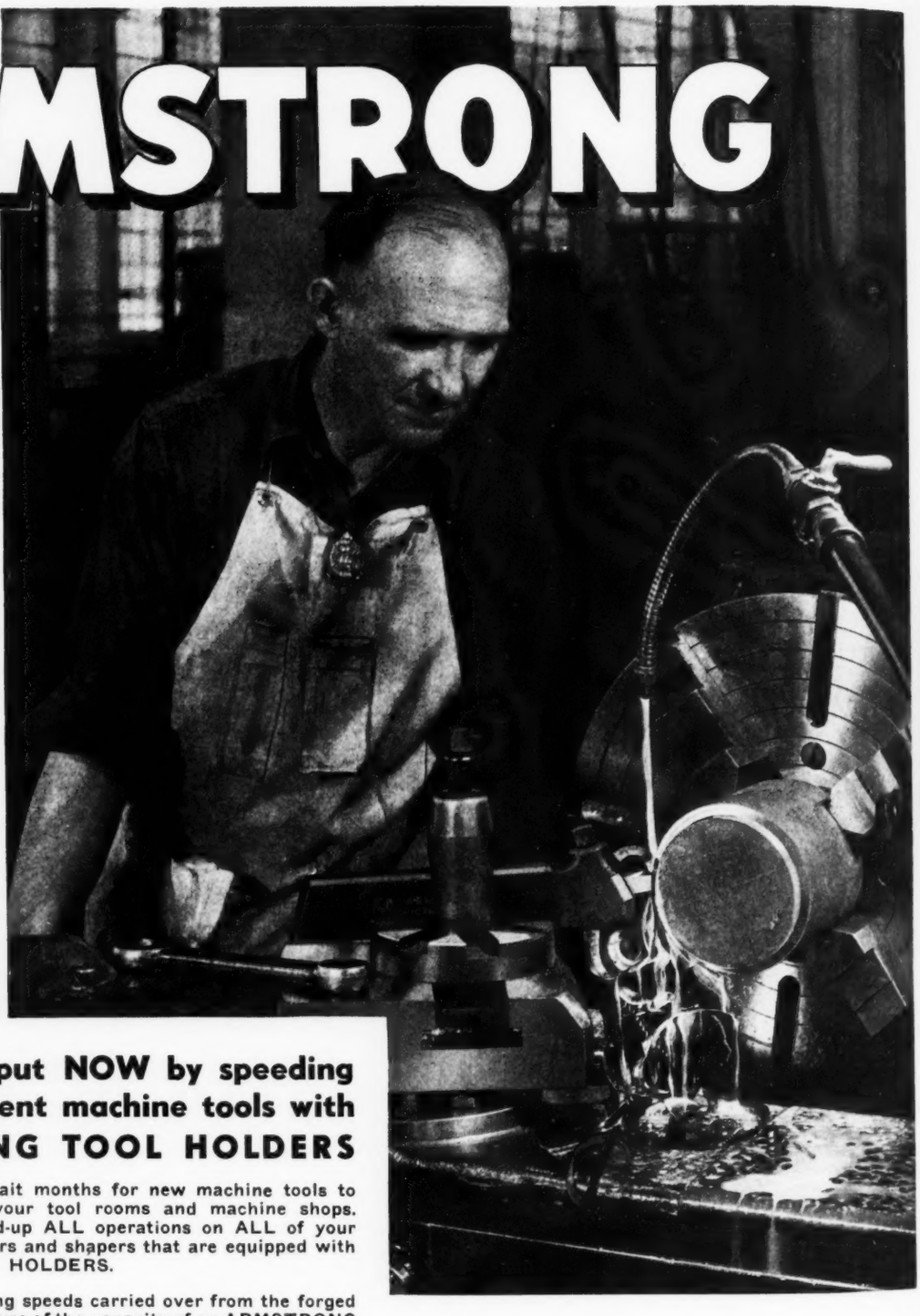
THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

then I said to myself—
IT'S METHOD-HOURS THAT COUNT!



ARMSTRONG



Increase output NOW by speeding up your present machine tools with ARMSTRONG TOOL HOLDERS

You don't have to wait months for new machine tools to increase output in your tool rooms and machine shops. You can safely speed-up ALL operations on ALL of your lathes, planers, slotters and shapers that are equipped with ARMSTRONG TOOL HOLDERS.

The "standard" cutting speeds carried over from the forged tool days are no measure of the capacity of an ARMSTRONG TOOL HOLDER. These stronger, modern tools will stand up to any speed or feed a machine tool can attain. "Standard" cutting speeds, as practiced generally, are not necessarily the most accurate or efficient cutting speeds. They were usually determined by backing down from the first "critical speed" (first vibration point). With the correctly designed ARMSTRONG TOOL HOLDERS, trial will usually show: (1st) a higher "critical" point and (2nd) a full range of smooth-cutting speeds beyond the first vibration point.

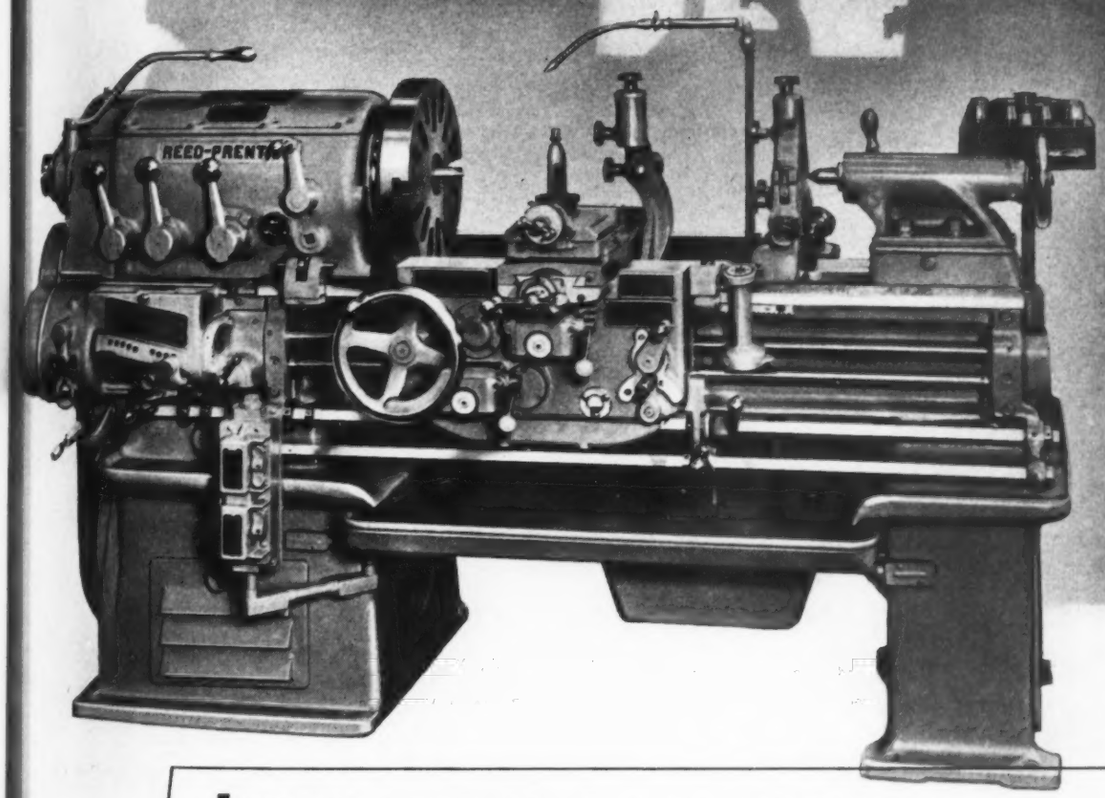
If you are trying to increase production, check your cutting speeds now. For maximum output and efficiency, be sure that you have the correct size and type of ARMSTRONG TOOL HOLDERS for each operation.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
313 N. FRANCISCO AVE. CHICAGO, U.S.A.

Eastern Warehouse and Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

MORE MODERN LATHES TO MEET WAR'S DEMAND



EVERY DAY, more Reed-Prentice lathes and milling machines are coming off the production line to take their places in the Victory effort. In the munitions plants, airplane plants, tank and transport plants — everywhere on the home front — Reed-Prentice equipment is doing its rugged share for ultimate victory.

On board our ships of war, Reed-Prentice lathes are helping to maintain our fighting equipment throughout the world.

Day and Night production continues with more to come. Over 55,000 square feet of additional assembly space is under construction. Reed-Prentice Corporation, Reed-Prentice workmen, Reed-Prentice Machine Tools are doing their share.

REED-PRENTICE CORPORATION

1213 W. 3d. ST., CLEVELAND **WORCESTER, MASS., U. S. A.** 75 WEST ST. NEW YORK

WISCONSIN MOTOR CORPORATION CUTS COSTS, DOUBLES PRODUCTION WITH CLEVELAND *Single Spindle* AUTOMATICS

● Down went costs and up went production for Wisconsin Motors Corporation when Model B Cleveland *Single Spindle* Automatics went to work on a variety of small, simple parts they require, in large quantities and small. Says a shop executive, "These machines are a step ahead in progress. Their excellent performance, low tooling costs, precision machining and productivity makes them profitable to operate."

Model B Clevelands are used throughout industry for metal turning jobs which are simple but where high production is required. Tap blanks, shafts with multiple diameters, nipples, various types of studs and pins, are all produced most economically on Model B machines.

Cutting tools can be mounted singly or in series for turning one or more diameters of various lengths. Double cross-slides carry forming and cutting-off tools. Built in long and short lengths to accommodate work up to 18-inch stock feed, Model B Clevelands can be equipped with rotary tilting magazines or hopper magazines for secondary operations. Model B will take work up to 2½-inch diameter bar stock.

If you have a type of job which you suspect can be best produced on Model B, ask our representative to call and talk it over with you. A bulletin describing Model B will be sent on your request.

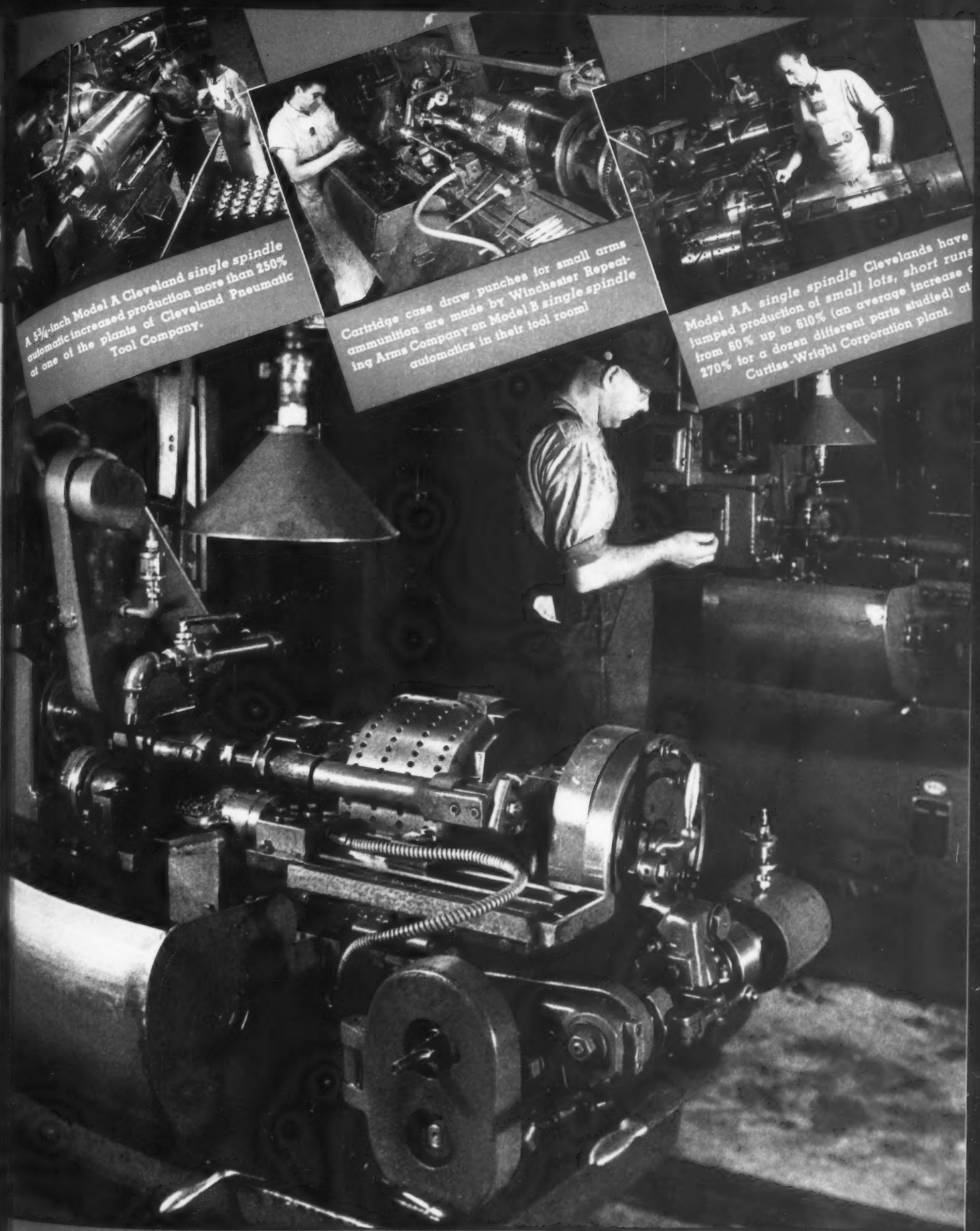
THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 ASHLAND ROAD • CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**



A 5¾-inch Model A Cleveland single spindle automatic increased production more than 250% at one of the plants of Cleveland Pneumatic Tool Company.

Cartridge case draw punches for small arms ammunition are made by Winchester Repeating Arms Company on Model B single spindle automatics in their tool room!

Model AA single spindle Clevelands have jumped production of small lots, short runs from 60% up to 610% (an average increase of 270% for a dozen different parts studied) at Curtiss-Wright Corporation plant.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2½-inch capacities inclusive

SLAB MILLS

FACE MILLS

SLITTING SAWS

END MILLS—REAMERS

HELICAL GEAR CUTTERS

SIDE MILLS

GEAR CUTTERS

FORMED CUTTERS

SPIRAL TAPER REAMERS

DOUBLE ANGLE CUTTERS

ALL ON THE OLIVER "ACE" TOOL AND CUTTER GRINDER!

Wide capacity, high speed, high accuracy and **extra** versatility make the ACE Universal Tool and Cutter Grinder indispensable for keeping tools in condition to handle the toughest war production jobs. The Oliver principle of tool grinding is the reason for the increased speed and wide range of the ACE; the tool is held stationary and the grinding wheel traverses the work. This method permits the use of the simplest of fixtures, only two of which are necessary to grind the majority of tools. The wheel has a stroke of 10" through a rack and gear and a 15" bearing, all fully protected from dust and grit.

Back up your production by equipping your toolroom with the Oliver ACE to assure maximum service and highest accuracy from every tool on every job. Write for bulletins.

Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1410 EAST MAUMEE STREET
ADRIAN **MICHIGAN**

Oliver
OF ADRIAN

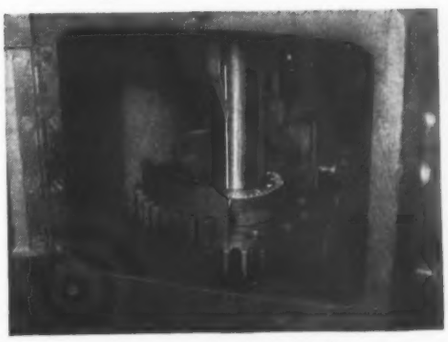
AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

Change Over is a matter of minutes on model LR Lo-swing LATHES

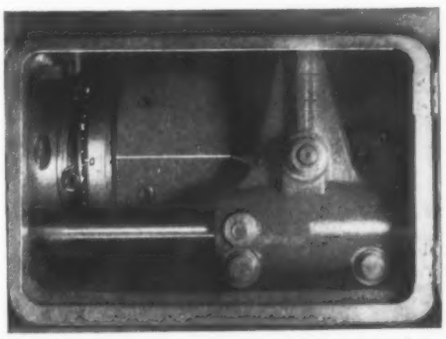
War production plants appreciate the speed and simplicity with which Lo-swing Automatic Lathes can be changed-over from job to job. Take Model LR for example: A hinged door provides easy access to the Simplified Change-Over Mechanism located on carriage front. Simply loosen two cap screws and move gear segment to graduation on scale corresponding to desired length of cut in inches. Tighten cap screws and carriage is timed for the job at hand. Cam is standard and does not have to be changed, and since the cycle is closed and locked, machine cannot get out of time.

Rapid traverse adjustment is accomplished with equal ease and speed thru the hinged door at the head end of machine. Loosen two cap screws and slide the ring which is graduated in inches around until the length of cut desired in inches is opposite the zero mark. This automatically positions the rapid traverse control cams so that the remainder of the cycle is completed in rapid traverse. A Rapid Traverse Control Handle, conveniently located just below the door opening further facilitates this adjustment and reduces change-over time.

These and other Lo-swing features, developed in the peace-time past, are now proving their value under the stress of war production.



Close-up view of Simplified Change-over Mechanism.



Close-up view of drum cam showing index line and graduated adjustment ring.

Seneca Falls

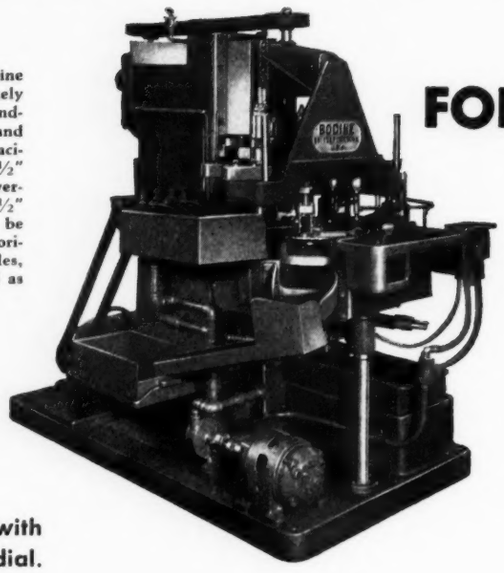
MACHINE COMPANY

SENECA FALLS, NEW YORK

BUILDERS OF Lo-swing LATHES

Bodine GANGS PRODUCTION TOOLS FOR Speed

Six standard sizes of Bodine machines cover an extremely wide range of needs in handling ordnance components and other parts . . . with capacities ranging from ¼" to ½" taps and drills and with vertical stroke from ⅛" to 3½" maximum. Machines may be equipped with vertical, horizontal or angular spindles, also spindles below as well as above the dial.



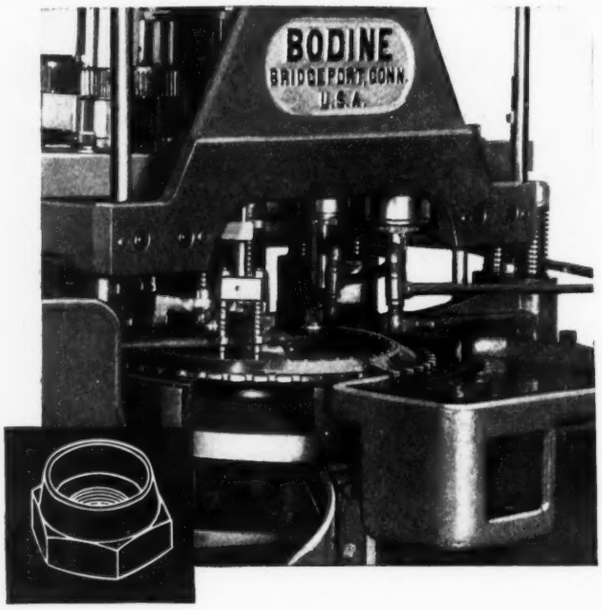
Bodine No. 48-20 with 18" dia. indexing dial.

The Bodine basic principle of design, of great advantage in peace-time, is doubly important now in saving precious hours on war production schedules.

By combining a series of drilling, milling, tapping and screw inserting operations in *one* machine . . . and providing for extreme flexibility in the locating of multiple spindles around an indexing dial . . . one operator directs simultaneous or sequence machining with a single tooling set-up. Work is manually or automatically fed into position on the dial, the operations being performed as parts progress from station to station. In many cases ejection is also automatic. Electrical interlocks protect machine and tools, assure safety of the operator.

Ganging of tools plus speed of operation, produce finished parts at a high rate per hour. Bodine design and precision construction permit production to extremely close tolerances.

War plants with one or a battery of Bodines are stepping up production easily and quickly on ordnance and other components. Ask Bodine for details. Send your blueprints or sample parts for engineering recommendation.



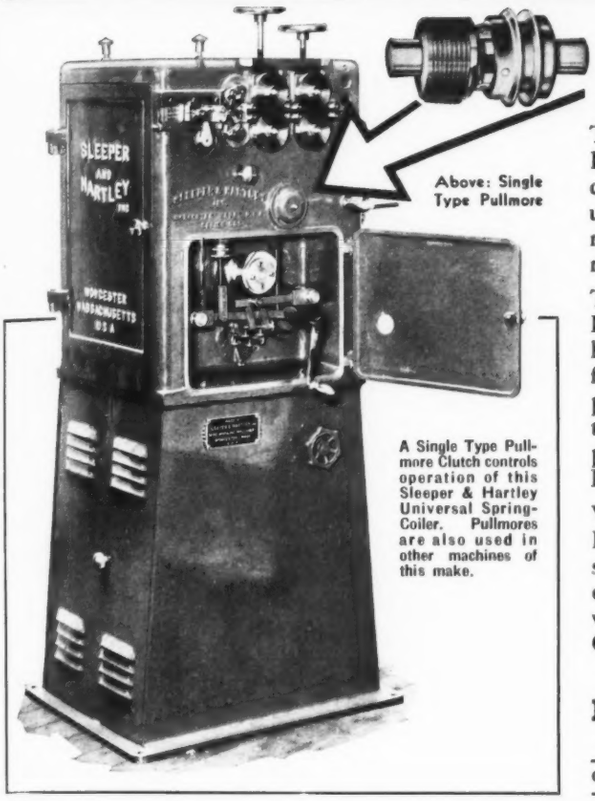
TYPICAL TOOLING FOR No. 48-20

Close-up shows the Bodine 48-20 Machine with tooling set-up and dial arrangement for drilling and tapping a special nut. Four drilling and two tapping spindles are used to produce two pieces per stroke of the machine, three operations on each piece. Feeding is by hand and ejections automatic. Speed is dependent upon material used, which may be aluminum, brass or any of the hi-alloy steel and stainless steel materials.

THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

PULLMORE CLUTCHES



Above: Single Type Pullmore

A Single Type Pullmore Clutch controls operation of this Sleeper & Hartley Universal Spring-Coiler. Pullmores are also used in other machines of this make.

Promote Maximum Performance—Durability "For The Duration"

Tough as the toughest pulling job, fast and smooth in action, Pullmore Clutches promote maximum performance in machines for wartime services . . . durability "for the duration" under continuous heavy duty. Notably compact, made in many standard capacities, they also simplify the design and manufacture of equipment.

That's why Pullmore Clutches are used in the Sleeper & Hartley Spring-Coiler, illustrated, and a long list of other high-grade products — machine tools, processing machines, fire equipment, cranes, hoists, rock crushers, lift trucks, press feeders, all kinds of multiple-disc clutch applications to main or auxiliary drives. Standard capacities range progressively from 1 to 90 h.p. at 500 r.p.m.; in Single or Double Types, for operation in oil or dry.

Write, today, for handy Pullmore Blue Book containing complete description, typical applications, engineering data on all sizes. Investigate also Rockford Plate Clutches: information on request.

Double Type Pullmore

Pullmore Clutches are Sold by Morse Chain Co. offices in principal cities

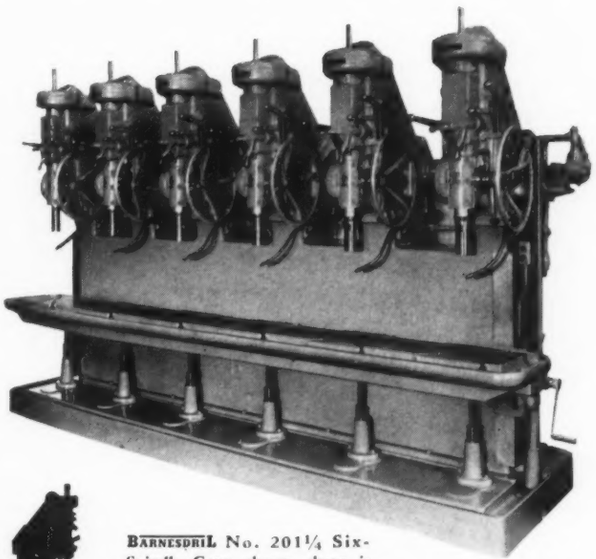
Rockford Drilling Machine Division Borg-Warner Corporation

▼ ▼ 310 Catherine Street, Rockford, Illinois, U. S. A. ▼ ▼

Over-Center Clutches • Spring-Loaded Clutches • Pullmore Clutches

Formula For High Production Drilling—

"BARNESDRIL"



BARNESDRIL No. 201¼ Six-Spindle Gang shown above is arranged with automatic reverse on two spindles; has 1¼" drilling capacity, 20" swing, box column. We make Gangs in various other head types and sizes, with from two to six spindles; also in Independent Round Column Style and Independent Square Column Style; and with Manual or Hydraulic Indexing Tables.

The name BARNESDRIL is a standard formula widely used in metal-working shops of the United Nations to get accurate high production on drilling, boring, reaming, tapping and kindred operations. For example, the Six-Spindle Gang illustrated is one of many BARNESDRIL Drillers now speeding output in war production plants.

BARNESDRIL Drilling Machines have exclusive Self-Oiling, All-Geared Drives, and other distinctive advantages that make them notably precise, productive, durable. Our Standard Single-Spindle Machines range from approximately ½" to 4½" drill capacity . . . Single-Purpose types with pick-off gears, General-Purpose types with quick-change speeds and feeds, and Hydrams with hydraulic feeds. Our Gangs and High Production Units utilize various combinations of these. Auxiliaries include multiple-spindle heads, fixtures, indexing tables and other special conveniences.

We are also largest builders of Hydraulic Honing Machines, Internal and External, for Conventional or Co-directional Process. Save time and insure best results by consulting our experienced engineers about any job that involves drilling or honing. Write for Catalog M.

Barnes Drill Co. 814 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

MADE IN ROCKFORD, ILLINOIS, U. S. A.

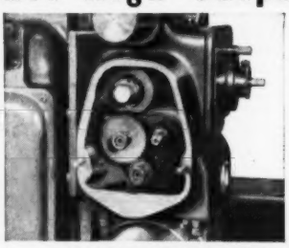
Engineered

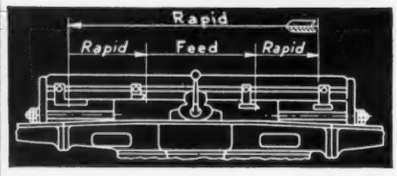
1800 Pieces an Hour
ON PARTS LIKE THIS ⇨

with Sundstrand No. 00 Rigidmil

Sundstrand Engineered Production on No. 00 Hydraulic Rigidmil illustrated provides unusual table-cycle and special fixture . . . nets 1800 pieces an hour climb-milling slots in small brass parts. Slots are 0.057″ wide ± 0.002″; 0.281″ deep ± 0.001″; 1½″ long. Same machine can be changed over quickly, with different fixtures and cutters, for high speed milling of other parts. Remarkable range of speeds, feeds, cycles, make standard Sundstrand Hydraulic Rigidmils extremely versatile and productive . . . best choice for war work and coming peacetime jobs.

Get High Output Milling Small Parts for Firearms, Fuses, Bombs, Instruments, Controls, Fuel Pumps, Similar Work





Speeds for Everything . . . Patented high-ratio head of No. 00 Rigidmil is made in two speed ranges, each having 64 spindle speeds—Type A, 57 to 2416 r.p.m.; and Type B, 85 to 3600 r.p.m.—for best milling in materials from steel to aluminum or magnesium.

Feeds for Everything . . . Standard Sundstrand Hydraulic Feed Unit gives any desired feed rate from ½″ a minute to 37″ a minute; or optional range from 1¼″ to 65″ a minute. Simple adjustment provides fast feeds for roughing cuts, slow feeds for fine finish.

Cycles for Everything . . . Rapid traverse at 400 inches a minute and hydraulic feed gives fast, accurately controlled, one or two-way, continuous or semi-automatic table cycles; provides high production at a minimum of operator effort. Easily adjusted standard dogs establish all usual table-cycles. Sundstrand Engineered Production Department will recommend special dogs and cycles for unusual conditions. Diagram at left shows cycle used on above job; includes three standard dogs and one special.

Early Deliveries . . . Standard No. 00 Hydraulic Rigidmils are available for early delivery. Write today for full information.

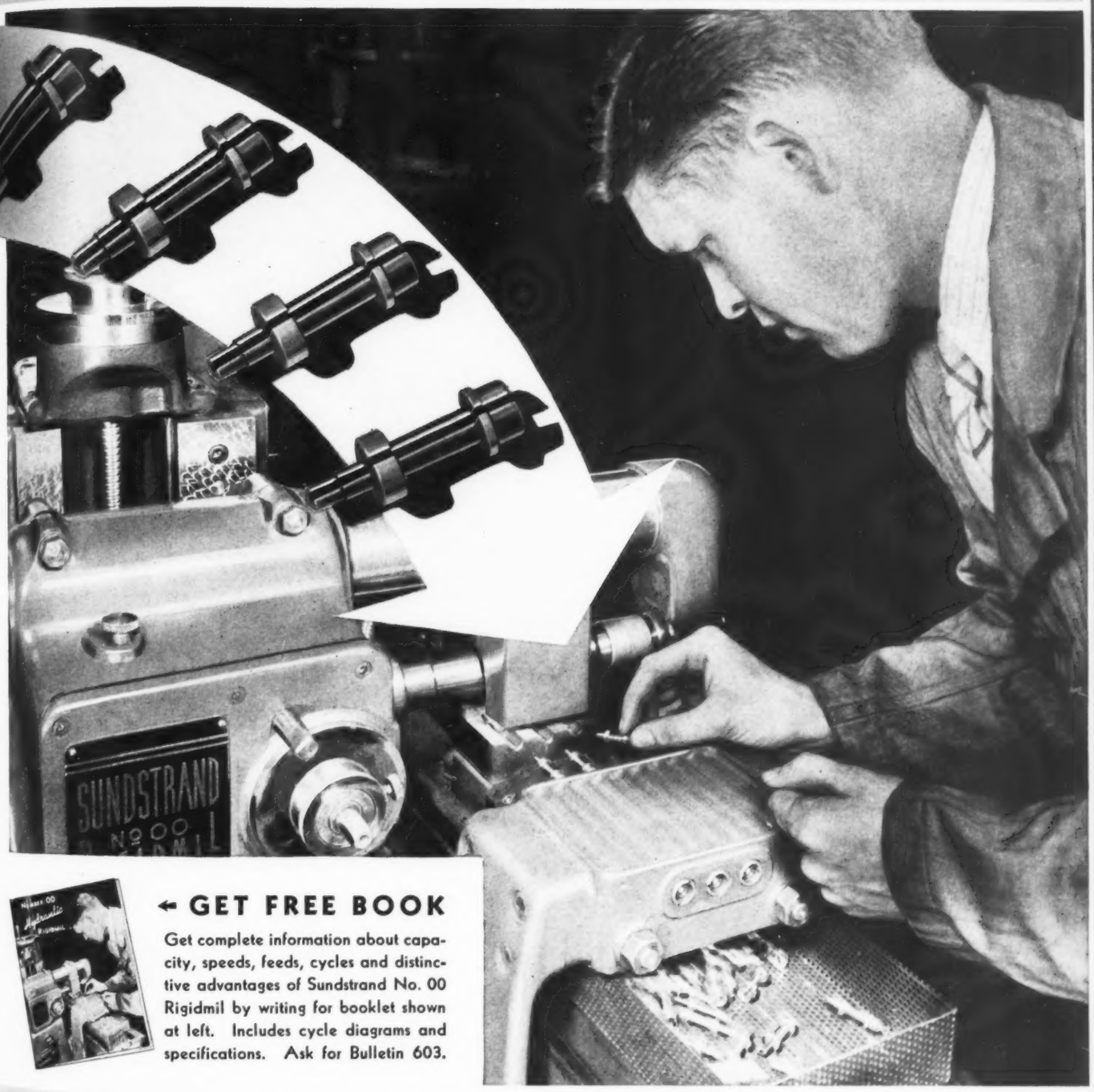
SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS, U.S.A. ·

SUNDSTRAND

2530 ELEVENTH STREET

MADE IN ROCKFORD, ILLINOIS, U. S. A.

Production



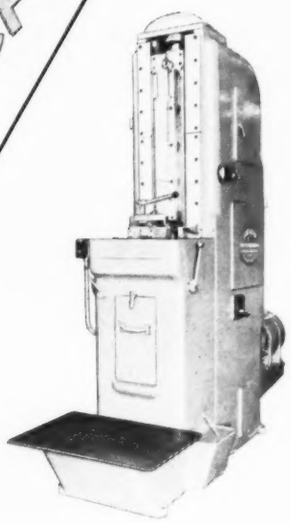
← GET FREE BOOK

Get complete information about capacity, speeds, feeds, cycles and distinctive advantages of Sundstrand No. 00 Rigidmil by writing for booklet shown at left. Includes cycle diagrams and specifications. Ask for Bulletin 603.

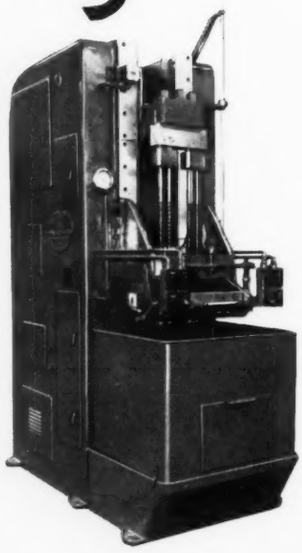
MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U. S. A.

MADE IN ROCKFORD, ILLINOIS, U. S. A.



Banking on AMERICAN for INCREASED PRODUCTION



Many producers of war materials have come to "Bank on American" for greater output. In these times of labor shortages it is imperative that maximum production be obtained with semi-skilled or unskilled help. It is significant, therefore, when a single American Broaching Machine can often replace a battery of other machines and give equal production results.

The AMERICAN T-10-36 3-way type machine, shown at upper right, is arranged for surface broaching flats on the breech end of carbine barrels at a high rate of production.

The machine shown at the left is an AMERICAN VP-4-25 ton 36" stroke vertical hydraulic broaching machine arranged for broaching two 1⅛" diameter holes 1-13/16" long through tank track end connectors.

AMERICAN BROACH & MACHINE COMPANY
ANN ARBOR, MICHIGAN, U. S. A.
BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Division of SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

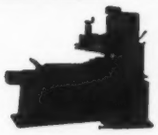
A Division of
SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U. S. A.

RECIPROCATING

Hy-Draulic

MACHINE TOOLS

Ram Type



Openside

SHAPERS

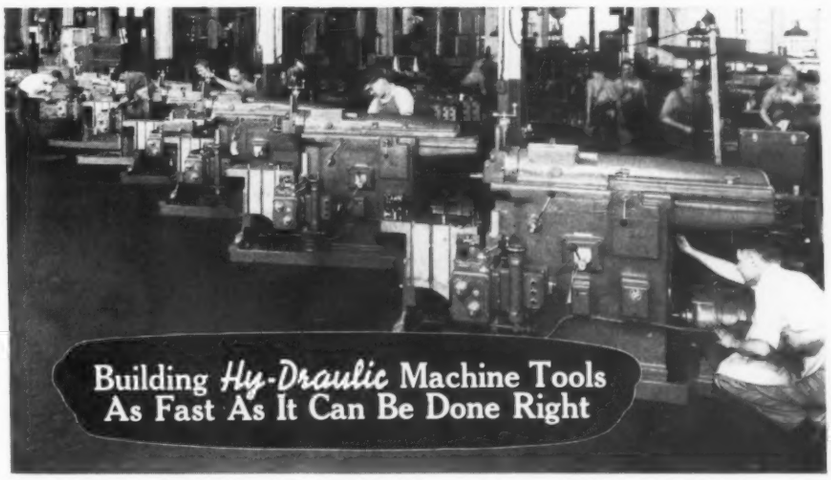
SHAPER-PLANERS

SLOTTERS

PLANERS

Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right

Throughout our plant willing hands are building Hy-Draulic Machine Tools as fast as it can be done right so that orders received *now* can be delivered promptly in accordance with official priority control.



Itellya They Help *Nip* The *Nazis!*

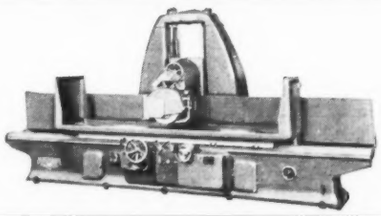
Sure as shootin', the Hy-Draulic Shapers shown above are now helping to battle Italians, Nipponese, Nazis . . . the whole Axis evil. Here and abroad, ashore and afloat, Hy-Draulic Machine Tools are serving with active fighting forces, and in the vast metal-working services of supply. Proved in peacetime operation, *all* Hy-Draulic Machine Tools are "naturals" on war work. Their high productive capacity, exclusive labor-saving features and precision give them high priority with production men. Investigate. Specify Hy-Draulic Machine Tools · · · — for Victory.

Hy-Draulic
Reg U S Pat Off

Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

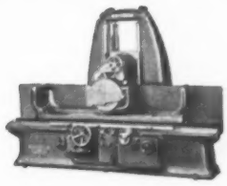
ROCKFORD, ILLINOIS, U.S.A.



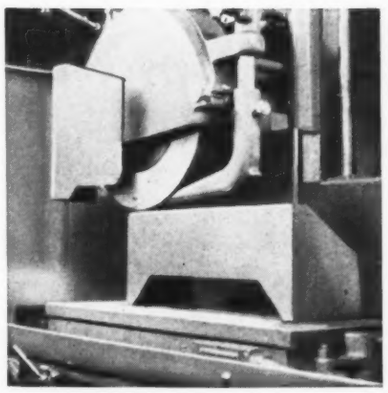
MATTISON

HIGH-POWERED

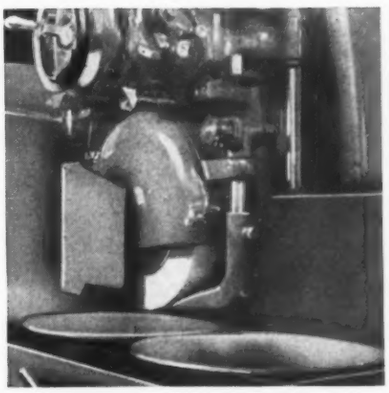
PRECISION SURFACE GRINDER



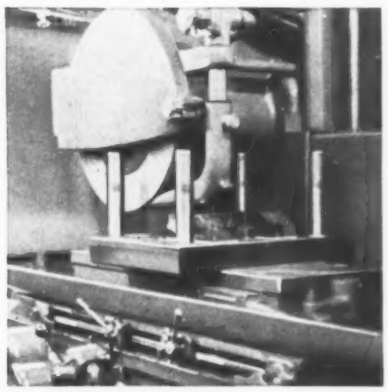
CUTS TIME ON VARIED TYPES OF WORK



Work: . . . . . Cast Iron Fixture Part
Stock Removal: . . . . . .015"—4 sides
Remarks:—Formerly milled requiring 3 hours. Now ground on Mattison 12"x36" Grinder in 1¼ hours.



Work: . . . . . Cast Iron Fixture Base
Stock Removal: . . . . . .025" each side
Remarks:—Formerly required 2 hours each. Now ground on Mattison 12"x36" Grinder in 1 hour per piece (2 pieces per set-up).



Work: . . . . . Die with leader pins in place
Stock Removal: . . Approx. .025" to sharpen
Remarks:—Formerly required 40 min. Now ground on Mattison 12"x36" Grinder in 20 min. Also saved 1½ hours assembly time, as leader pins were not removed.

MATTISON MACHINE WORKS—ROCKFORD, ILLINOIS

MADE IN ROCKFORD, ILLINOIS, U. S. A.

LOWER COSTS ON TOUGH SPLINE HOBBING

BARBER-COLMAN TYPE "D" HYDRAULIC HOBBING MACHINE

PERHAPS the most significant feature of this machine in comparison with others of comparable size and capacity, is the fact that it uses a 10 h.p. motor while most of the others use a 5 h.p. motor. This greater driving power means greater metal-removing capacity, and greater production. Greater production is of little value without accuracy and rigidity to meet modern gear-tooth tolerances, so you will find in the Type "D" many distinctive construction features which insure maintenance of a high degree of accuracy. Furthermore, to provide a feed range with infinite variations, for advancing the carriage, for setting and clamping the overhanging arm, and to reduce operator fatigue, HYDRAULIC drive is used. Lead remains a direct product of change gears used.

HOLDS CLOSE LIMITS . . .

The part shown in the above illustration is a tractor axle shaft which must be able to stand heavy shock loads, as well as transmit a considerable amount of power. These conditions require a tough and accurately-machined spline shaft. To insure accuracy, the splines are hobbed after heat treatment to 269-302 Brinell. On the Type "D" machine, production is one shaft every 30 minutes, and the splines are parallel within .004" measured over rolls. This is an excellent example of the production and accuracy obtainable with a Barber-Colman Type "D" Hobbing Machine.

DATA ON THIS SPLINE JOB . . .

Material — 1050 H.R. Steel.

Hardness — 269-302 Brinell.

Splines — 16 splines, 14-7/8" long, 2.121" O.D., 1.791" root dia., involute form, 30° P.A.

Hob Speed — 66 R.P.M.

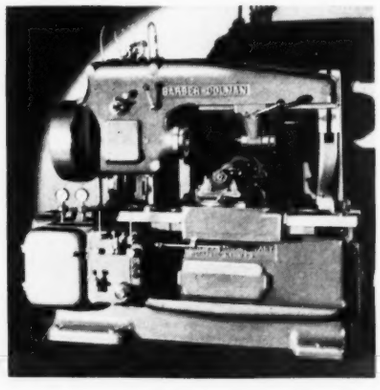
Hob — B-C 3-1/4" x 4" x 2" taper hole, ground, topping, single-thread.

Feed — .082" per rev. of work.

Production — 48 min. per piece, floor-to-floor.

Pieces per Hob Sharpening — 36.

Accuracy — Splines parallel within .000"-.004" measured over .280" rolls. Across individual splines within .001". Spline profile tolerance .0015".



Further details and full specifications on the Barber-Colman Type "D" Hobbing Machine are given in descriptive circulars which will be furnished on request. Ask for Bulletin F1477-1 or consult your Barber-Colman representative.

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 204 Loomis Street, Rockford, Illinois, U. S. A.

MADE IN ROCKFORD, ILLINOIS, U. S. A.

● For posting on bulletin boards and shop walls in Linde customers' plants, a two-color version of the poster shown above is available. These posters will remind your employees of the vital need for fullest utilization of existing stocks of oxygen and acetylene cylinders and will thus help assure your gas supply. Ask any Linde office for the quantity you require, specifying Form 5104.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

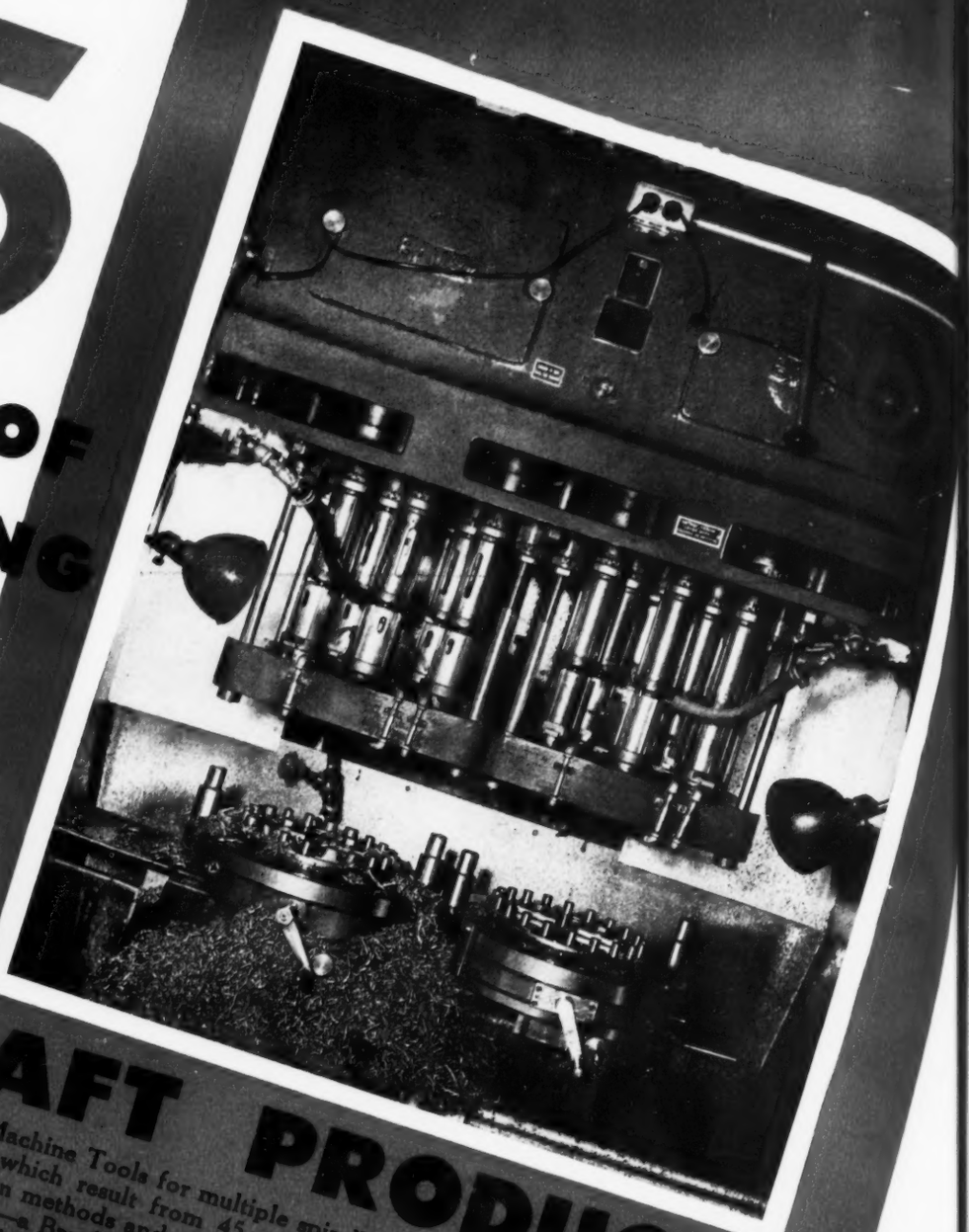
30 East 42nd Street, New York, N.Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD APPARATUS . . . OXWELD SUPPLIES

The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

45 YEARS OF PIONEERING *pays dividends in* AIRCRAFT PRODUCTION



Baush Machine Tools for multiple spindle operations are built with numerous features which result from 45 years of pioneering and specializing in high production methods and equipment. The application of one of these production tools—a Baush Multiple Spindle Drilling Machine—is shown in action at a Wright Aeronautical Plant. Here the Machine is equipped with drill head with two groups of five spindles employed to hollow-mill and face the trunnions around aircraft engine gear carrier rings. Previously these trunnions were machined one at a time; now ten are machined at one feed of the drill heads, the pieces are indexed for machining the next ten, and so on to finish the trunnions on two gear carrier rings speedily and simultaneously. Baush features include a rapid approach and a selected slow feed, hydraulically operated. Other features, which pay dividends in improved wartime production, are listed in folder on Baush hydraulic Multiple Spindle Machines. Write for your copy.

BAUSH MACHINE TOOL COMPANY

MEANS BUSINESS

SPRINGFIELD, MASS., DETROIT, MICH.

Anytime

IN WAR OR PEACE—

you can depend on Morse Silent and Roller Chain Drives to provide capacity and stamina to keep maximum production rolling, free from costly maintenance or breakdowns.

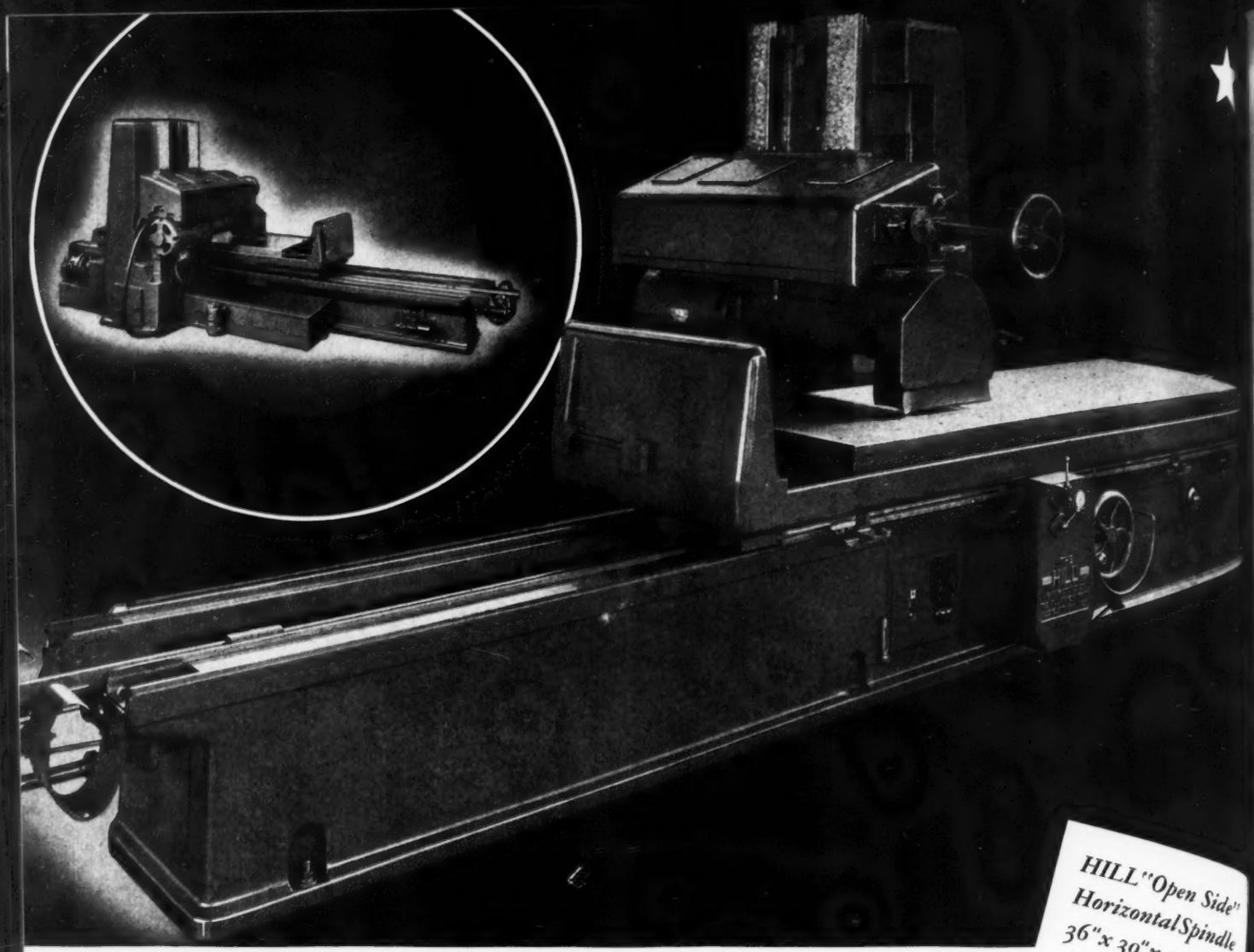
Reliability and high efficiency in capacities from fractional to thousands of horsepower.

That is what all big production needs.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP



HILL "Open Side" Horizontal Spindle 36" x 30" x 120" Hydraulic Surface Grinder — with HILL rectangular magnetic chuck in place

★ IT'S EFFICIENT
★ IT'S ACCURATE
★ IT'S ADAPTABLE

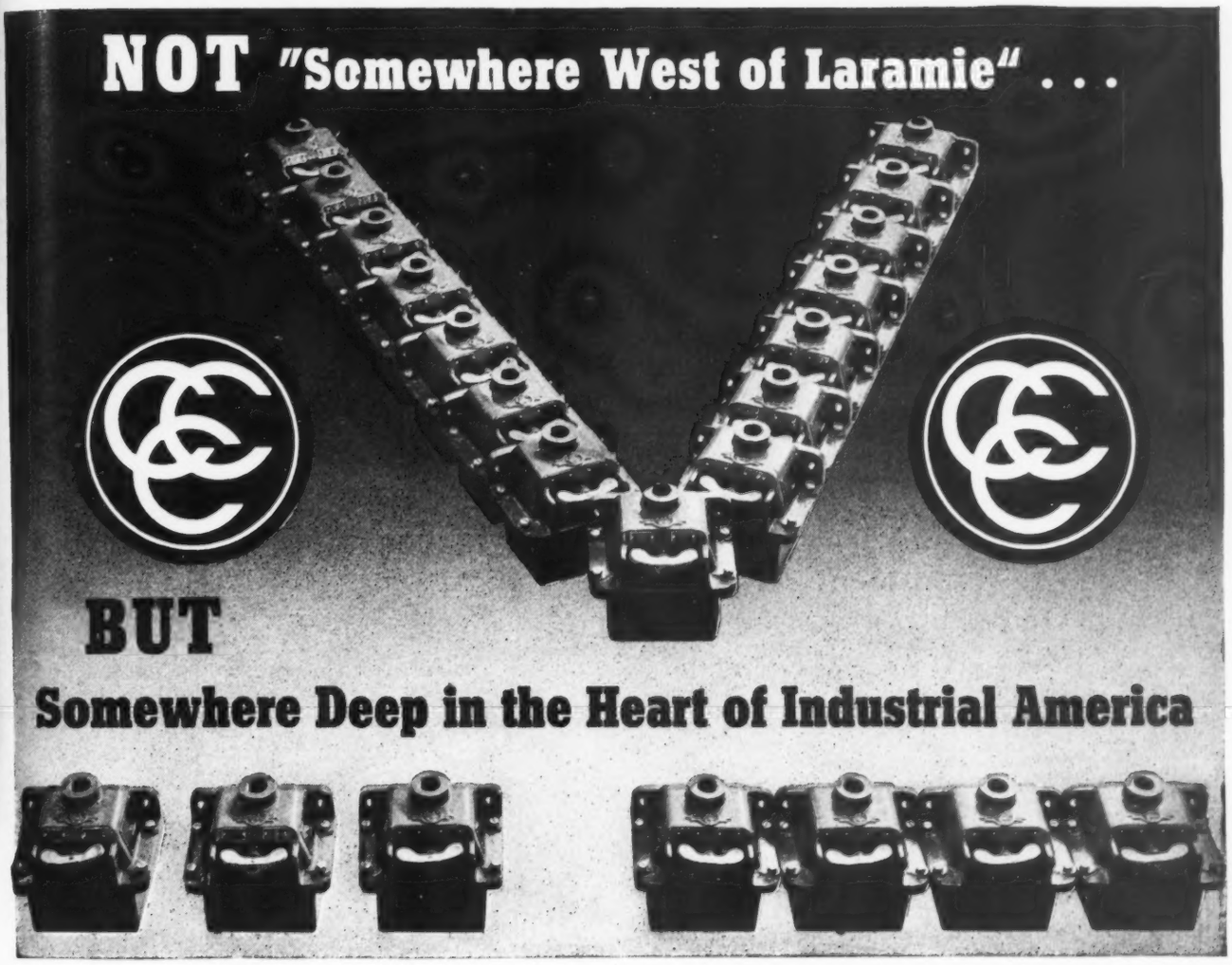
Users of HILL "Open Side" Hydraulic Surface Grinders consistently report production increases of 200 and 300% over previous methods of finishing. —That's real EFFICIENCY. . . . HILL Heavy Duty Hydraulic Grinders are working to tolerances of .0005" day after day, at speeds up to 100 feet per minute. —That's ACCURACY. . . . HILL Horizontal Grinders are ideal machines for special purpose grinding, production operations, or as general utility tools for grinding flat or irregular surfaces. —That's ADAPTABILITY. . . Table widths on HILL "Open Side" Horizontal Spindle Surface Grinders are 18", 24", 30" and 36". Table lengths range from five to twenty feet. Bulletin "M" gives you full and detailed information.

ALSO BUILT IN VERTICAL SPINDLE DESIGN

The HILL ACME CO.

A consolidation of two nationally known, fifty year old manufacturers:—The Hill Clutch Machine & Foundry Company . . . and The Acme Machinery Company
6400 BREAKWATER AVE., CLEVELAND, OHIO

NOT "Somewhere West of Laramie" . . .



BUT

Somewhere Deep in the Heart of Industrial America

Maybe in an explosives plant—maybe where gas fumes lurk—maybe in dust laden atmospheres—but someplace where an explosion would wreck an industrial plant—these "3C" Bulletin 100, Type D Heavy Duty Push Buttons are "lined up" in a "V for Victory" Production Drive.

They're built to rigid underwriters' specifications for Class 1, Group D, Hazardous Locations, either with or without oil. The addition of oil eliminates the action of corrosive gas, and smothers any arc generated at the contacts.

Conveniently located operating lever can be manipulated with a gloved hand—but ample guards on each side prevent accidental operation—and the Station can be locked in either "OFF" or "STOP" position.

The same sturdy mechanism found in all "3C" Type D Push Buttons is used in these Explosion Proof Buttons—Silver to Silver Button Type Double Break Contacts—Bakelite Insulation Parts—plenty of clearance and wiring space—all parts replaceable with screw-driver—and other features.

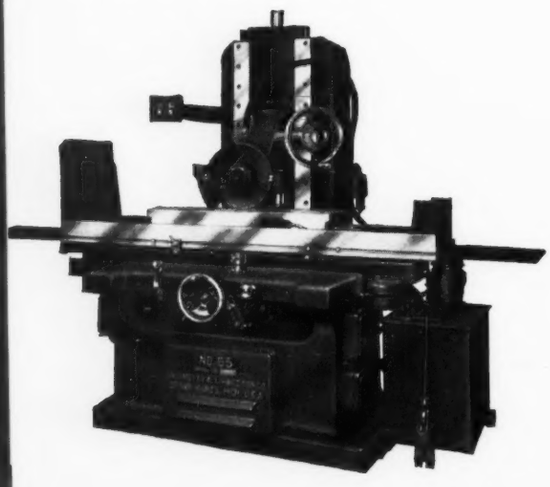
OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

That's Precision!

Below: The No. 55 Grand Rapids Hydraulic Feed Surface Grinder with 12" x 36" working table, infinitely variable table speeds up to 125 F.P.M. Other grinders in this series with table sizes from 6" x 18" to 14" x 48".



. . . and the Grinder is a

GRAND RAPIDS

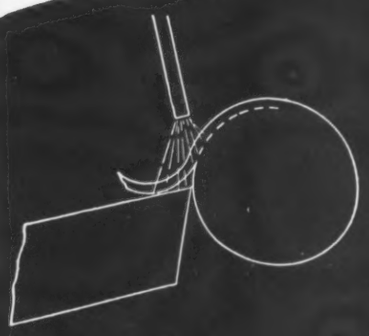
In grinding a relief around trigger casings for 20 mm anti-aircraft machine guns, an important requirement is that the line between this surface and the cylindrically ground surface be straight and sharp. In the plant engaged in making these guns, a Grand Rapids Hydraulic Feed Surface Grinder is used to do this precision job. The operator revolves the work in small increments between successive table strokes while stock to a depth of .022" is ground away.

The hydraulic control of table movement which makes this job possible is but one of the many precision features of Grand Rapids Surface Grinders. Wheel elevation can be controlled well within limits of .0001", and the rugged one-piece column and base construction maintains this accuracy under the severest kind of constant use. Write for Catalog GL-100, describing these and many other features of the complete line of Grand Rapids Hydraulic Feed Surface Grinders — for toolroom precision on all types of munitions production jobs.

GALLMEYER & LIVINGSTON CO.

305 STRAIGHT AVE., S. W., GRAND RAPIDS, MICH.

TOOL-LIFE INCREASED 25%



Despite the heat of 28 tools cutting at one time, the chip flows freely across the rake of the tool. No jamming; no marred finish. Texaco Transiltex A in use.

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

Tune in the TEXACO STAR THEATRE every Sunday night—CBS

Machining the cooling fins of aviation engine cylinders in the Fay Automatic Lathe . . . using three gangs of 28 tools each . . . the tool-life has been stepped up 25%.

This is typical of the results that you, too, can get through the proper selection and application of Texaco Cutting Oils.

On various kinds of war work, Texaco is increasing output, lengthening tool-life, decreasing down-time, improving finish.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

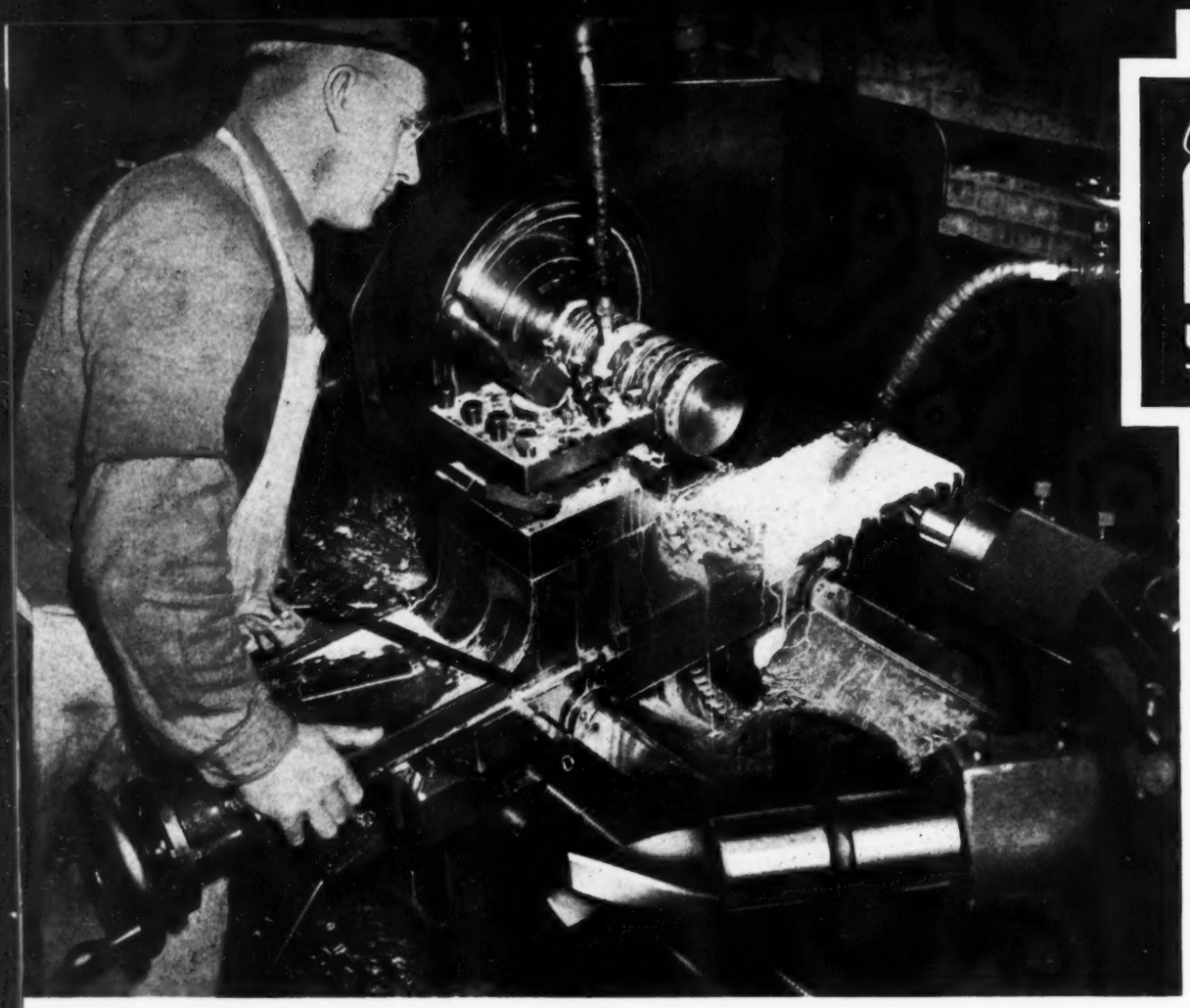
Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in the application of cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write: The Texas Company, 135 E. 42nd St., New York, N. Y.

Care for your Car ..for your Country

TEXACO REG T M

TEXACO Cutting Oils
FOR THE METAL-WORKING INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

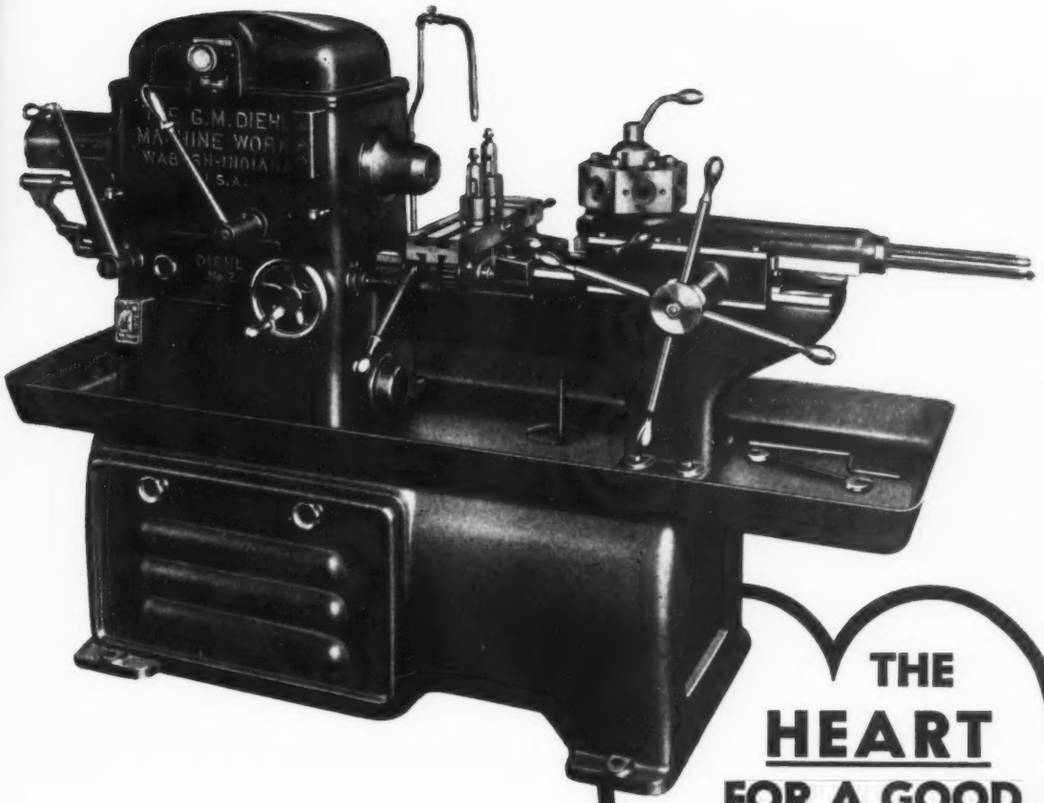


LOAD THEM UP!
TURN THEM FAST!
to Speed Production for VICTORY!

Cincinnati-Acme Universal Turret Lathes have the correct speeds to take full advantage of fast-cutting carbide tools. At the American Locomotive Works, the 3S Cincinnati-Acme Universal Turret Lathe shown above is roughing out blanks for locomotive knuckle pins from 4½" diameter bar stock.

To insure accurate performance on jobs like this, both the square and the main turrets of Cincinnati-Acme Lathes are mounted with unusual rigidity. The square turret saddle is gibbed to both vees and a third taper gib on the front of the bed is extra assurance of rigidity. A wide inverted dovetail holds the cross-slide to the saddle. That is why we say that, with Cincinnati-Acme Universal Turret Lathes, you can load up to full capacity, turn at the highest speeds and get maximum output on all your jobs of production for Victory!

The ACME MACHINE TOOL CO.,
... CINCINNATI, OHIO.



THE **HEART** FOR A GOOD MACHINE

GUSHER COOLANT PUMP

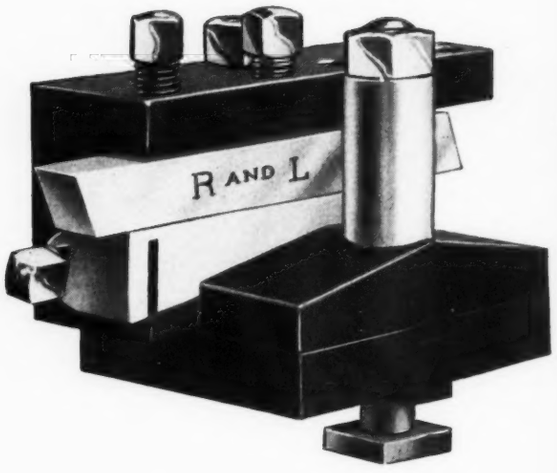
SPLIT-SECOND COOLANT DELIVERY SPEEDS WAR PRODUCTION JOBS!

No priming! With Gusher Pumps coolant flows instantly, the split-second the motor is started. And this flow can be controlled — opened up to a gusher or throttled down to a thin stream—without building up pressure or harming the pump in any way. These features are especially valuable on machine tools such as the Diehl Turret Lathe illustrated above, where jobs varying greatly in size and type are performed. By equipping this lathe with a Model 1-P3 Gusher Pump immersed in a standard tank unit inside the base, every coolant requirement for any job can be met instantly.

The dependable, versatile operation of Gusher Coolant Pumps, which helps to maintain the constant efficiency of every Ruthman-equipped machine, is the result of a unique combination of features. Let us tell you more about the design of Ruthman Pumps and how they are giving all types of machine tools "hearts" that are capable of constant, high speed operations on war production jobs.

THE RUTHMAN MACHINERY CO.
1809-1823 READING ROAD
CINCINNATI OHIO

On Turrets...



and Cross-slides

RIGHT R AND LEFT L TOOLS ARE SPEEDING PRODUCTION!

Getting greater machine efficiency by performing two or more operations simultaneously . . . by speeding tooling-up and tool replacement . . . by insuring constant accuracy, R and L Tools are helping manufacturers to attain their goal of maximum war production.

The R and L Turning Tool is built in 5 sizes to cover a wide range of turret lathe and screw machine jobs. It can be tooled up to perform such combinations of operations as drilling and turning; turning, centering and burnishing; turning several diameters, etc. It can be changed in ten seconds from right- to left-hand operation. This single, simple tool does the work of a dozen or more separate tools, saving in tool costs as well as in time.

The R and L Tool Post is simply designed yet it is capable of holding square or flat tools on the front or rear cross-slide with the spindle running in either direction.

These R and L multiple-use, multiple-operation features are the reasons why they are chosen to increase the capacity of so many war production plants. Write for your copy of the R and L Idea Booklet that will show you how these versatile tools may be used to speed up and improve your operations.

R AND L TOOLS

1825 Bristol Street, Nicetown, Philadelphia, Pa.

War on *Wear!*

MANHATTAN'S Suggestions for the Care of V-BELTS

Rubber has so many essential applications in the war production program that scarcity must be overcome by conservation in every way possible.

Making V-Belts last longer is more than common sense; it is a patriotic contribution to the "winning-power" of the country. Follow these important suggestions:—

1. Do not allow oil, grease or gasoline to come in contact with belt.
2. Avoid exposing belts to sunlight and excessively hot or cold weather.
3. Provide take-up facilities.
4. Don't leave tools or other objects near belt to get caught in drive.
5. Avoid abrasion on nearby objects.
6. Do not force belts onto sheave with instruments of any kind. Slack off on take-up and place belts into grooves.
7. Work belts around grooves until all of the slack is on ONE SIDE OF THE DRIVE, then tighten take-up until belts are fairly snug.
8. Before starting check pulley alignment, check bearings for oil and see that drive is clear and free. Adjust take-up so that when drive is operating at full load and full speed, only a slight bow appears on slack side. Vertical drives, extremely short center drives, and drives carrying pulsating loads must be operated tighter than others.
9. Use sufficient number of correct sized belts to handle maximum load. Be sure sheaves are over accepted minimum diameters.
10. Design new drive to take standard belt and sheave sizes.
11. Belts must not bottom in grooves. Bottoming causes belt-destroying heat from slip.
12. Do not use belt dressing. If belts slip, clean with cloth dampened in gasoline and tighten drive slightly.
13. See that sheave grooves are free from burs and extreme wear. Replace worn sheaves and check alignment periodically.
14. On failure of first belt on a drive, replace entire set with new belts, keeping worn belts as spares for subsequent failures.
15. Store belts uncoiled and hung over forms on rack or wall in a cool, dark place.
16. Consult your MANHATTAN service man. Write factory or your distributor.

You can get reprints of these suggestions for maintenance men from MANHATTAN field representatives or distributors or by writing direct. This is No. 3 of a series on rubber conservation. Wall cards on care of belts and hose are also available.

V-Belt destroyed by insufficient tension. High slip created excessive heat which wore and cracked cover.

KEEP AHEAD WITH MANHATTAN

Conserve your rubber equipment; salvage worn out rubber and buy WAR BONDS—three steps to Victory.

THE MANHATTAN RUBBER MANUFACTURING DIVISION
of RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

WITH D&T Tubular Micrometers you can maintain tool room accuracy on large, unwieldy work — check inside and outside diameter measurements in thousandths from 0" to 168" (in 6" steps). The feather-touch lightness of these precision instruments makes it easy to detect the slightest inaccuracy.

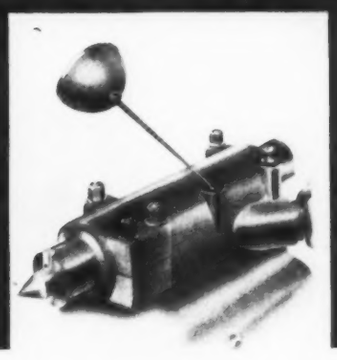
Durably constructed for long, hard service, D&T Tubular Micrometers have a light, rigid frame of hollow, cold drawn steel, with drop-forged ends welded on to hold the sliding ground bar and micrometer head. Available in crescent or bar types in 45 different sizes.

An indispensable tool for manufacturers of heavy equipment, for steel mills, paper mills, engine plants, and especially for producers of armament. Write for a copy of the new bulletin describing all D&T Tubular Micrometers.

DAVIS & THOMPSON CO. • MILWAUKEE, WISCONSIN, U. S. A.

I'm Tellin' You...

Head Stock — Don't let oil level get below one inch from top of intake. Use a good grade of machine oil SAE 30.



Tailstock — This top unscrews. Keep the felt filtering pad saturated by daily oilings from a can.

Apron — Keep SAE 30 oil at a level where it can be seen at intake. Work plunger in and out slowly 3 or 4 times daily.

Feed Box — Keep the felt filtering pad in the trough saturated by daily oilings from a can.

THE R. K. LEBLOND MACHINE TOOL CO.

Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathe

←This GEAR BOX is the

TURNER

UNI-DRIVE

Motorizes Machine Tools

IT DOES THE JOB

on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Brown & Sharpe and Cleveland Automatic Screw Machines.

The old way is too slow today. More speed... greater production... you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift... save time... speed up work... keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* motor drive.

Easily and quickly installed. They do away with overhead counter shifts... no belts to shift. Increase the efficiency of machine and operator. Drive on large cone at all speeds. One trial will thoroughly convince you.

Right now — today... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

THE TURNER UNI-DRIVE COMPANY

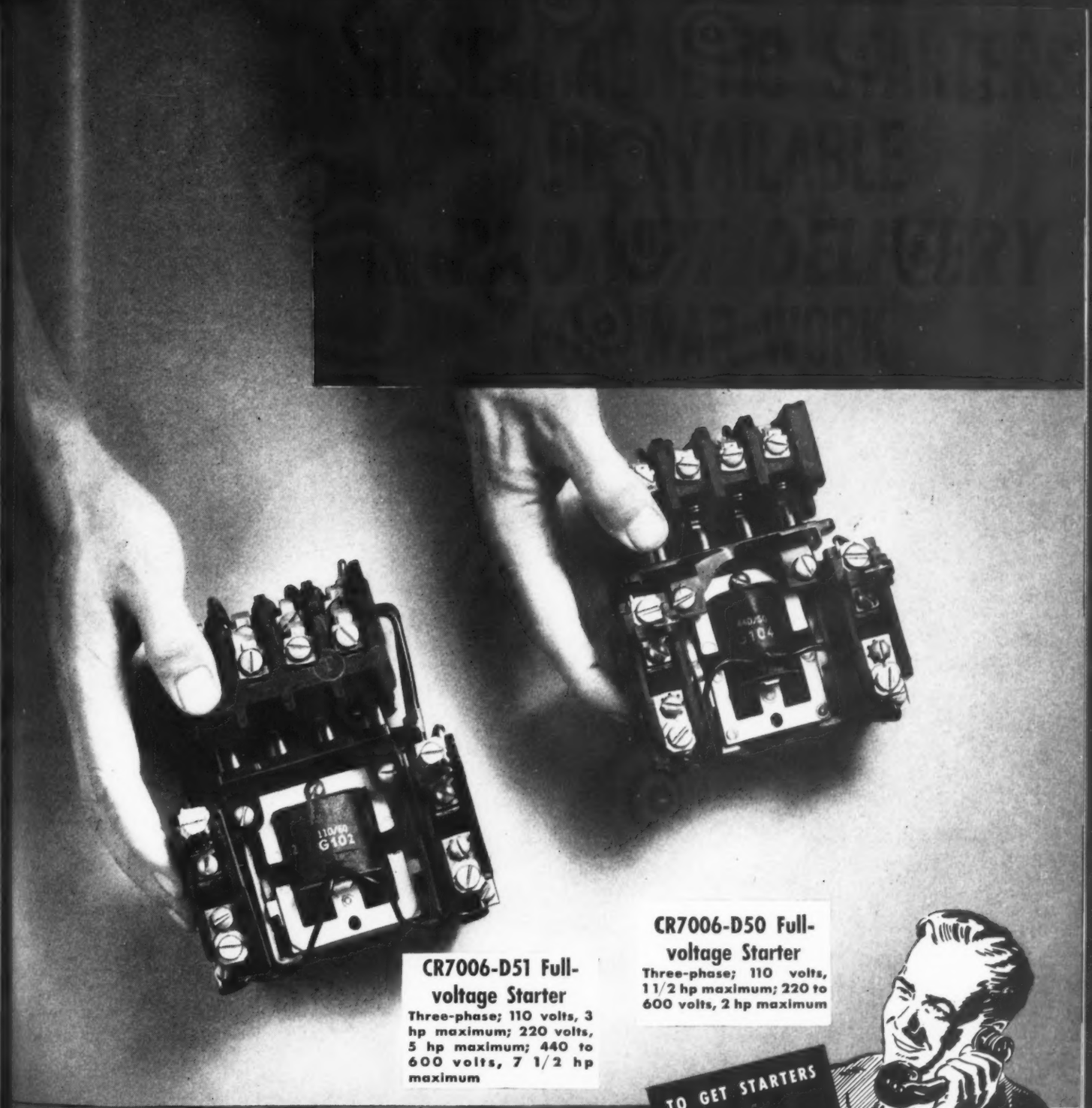
(Sales Division: Turner Machinery Co.)

3416 Terrace St. **Kansas City, Mo.**

SOME USERS OF TURNER UNI-DRIVE

- American Brake Shoe & F. Co.
  - Kellogg Division
  - Southern Wheel Division
- Arnold Schwinn & Co.
- Augusta Arsenal
- Automatic Sprinkler Co. of America
- Bendix Aviation Corp.
- Burgess Battery Corp.
- Cessna Aircraft Corp.
- Champion Dishwashing Co.
- Chicago, Rock Island & Pacific R. R. Co.
- Chicago Screw Company
- Combustion Engineering Co.
- Congolium Nairn, Inc.
- Doehler Die Casting Co.
- Driver Harris Co.
- Electric Auto-Lite Co.
- Fostoria Screw Products Co.
- Frankfort Arsenal
- Frisco Lines
- Hartzell Industries
- Imperial Brass Mfg. Co.
- International Projector Co.
- Kohler Corp.
- Koppers Corporation
- Lion Mfg. Co.
- Missouri Pacific R. R. Co.
- Monsanto Chemical Co.
- The New York Air Brake Co.
- Ohio Pattern and Fdry. Co.
- Oneida, Ltd.
- Pennsylvania Railroad
- Perth Amboy Dry Dock Co.
- Pomona Pump Co.
- Proctor & Gamble Co.
- Republic Steel Corporation
- Revere Copper and Brass, Inc.
- SKF Industries
- Sullivan Dry Dock Co.
- Thos. A. Edison Co.
- The Timken-Detroit Axle Co.
- Toledo Scale Co.
- The Todd Company
- Wabash Railway Co.
- Wagner Electric Co.

"Speeding Production is a cinch with our new UNI-DRIVES"

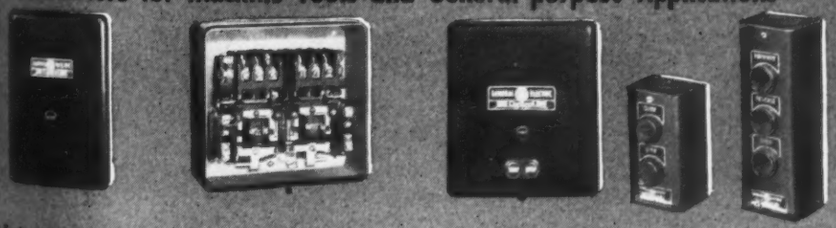


CR7006-D51 Full-voltage Starter
Three-phase; 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7 1/2 hp maximum

CR7006-D50 Full-voltage Starter
Three-phase; 110 volts, 1 1/2 hp maximum; 220 to 600 volts, 2 hp maximum

TO GET STARTERS IN A *hurry...*

Starters for Machine Tools and General-purpose Applications



Enclosed CR7006-D50 Starter
Three-phase; 110 volts, 1½ hp maximum; 220 to 600 volts, 2 hp maximum.

CR7009-B31JD Magnetic Reversing Starter
Three-phase; 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7½ hp maximum.

Enclosed CR7006-D51 Starter with Push-button in Case
Three-phase; 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7½ hp maximum.

CR2943 Push-button Stations
These accessory stations are available for either START-STOP or FORWARD-REVERSE-STOP service.

JUST pick up your phone and call the nearest G-E office. Tell us your priority rating and the type of starter you want. In most cases, we'll be able to have your starter, or starters, on the way to you before the end of the day.

Centrally located warehouses which carry an ample stock of the popular sizes and types of magnetic starters make this kind of service possible.

When you need motor control in a hurry, call your local G-E salesman. In most cases he will have just what you need in stock. *General Electric, Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

GENERAL ELECTRIC

676-42-8490

The development of American machine tools under the whip of war will be rated an outstanding achievement in modern industrial history.

One prominent feature of this development is the tremendous increase in the use of Timken Tapered Roller Bearings. Whereas many heavy duty machine manufacturers formerly used Timken Bearings only on spindles, they now also are using them extensively in headstocks, gear boxes and feed mechanisms, resulting in greatly increased operating speeds, higher precision and lower cost.

These advancements not only are enabling armament manufacturers to keep ahead of their war program obligations; they are pointing the way to success under the competitive conditions that probably will follow Victory.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN

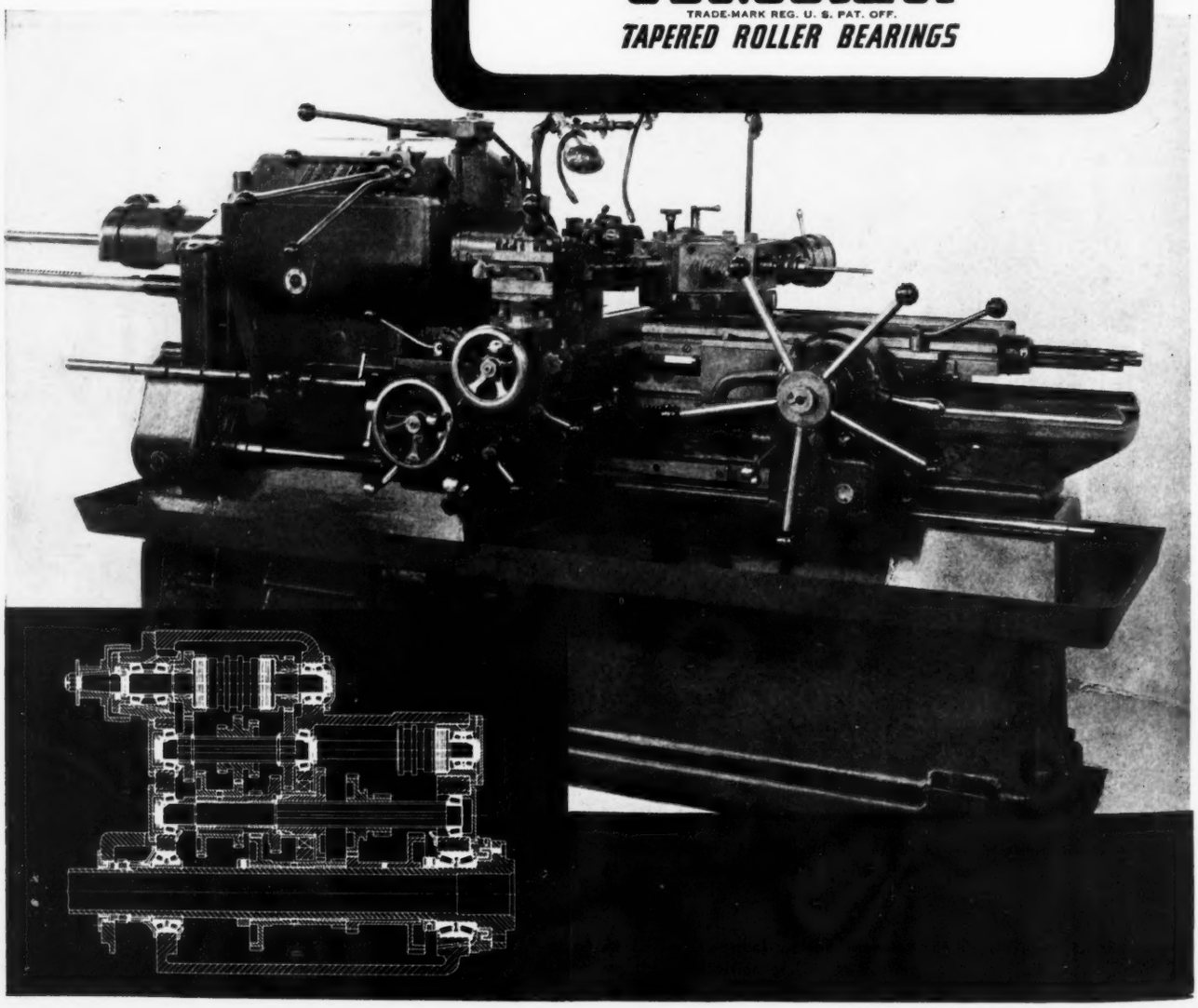
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

V ··· —

TO ASSURE VICTORY

BUY UNITED STATES WAR SAVINGS BONDS & STAMPS

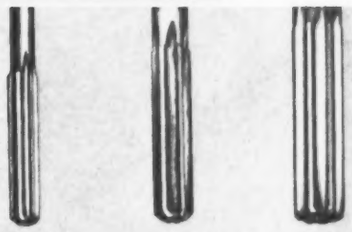


FAST

PRODUCTION WITH ALL SIZE TOOLS

DRILLS

Speeds up to 3500 R.P.M. available for all small drilling. Capacity up to 5/8" in steel.

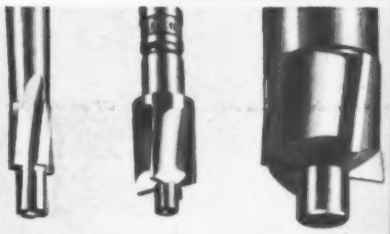


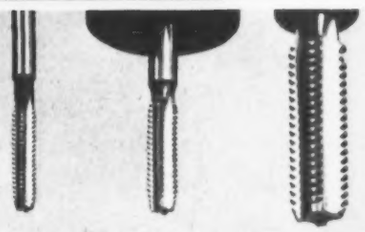
REAMERS

A wide range of speeds in 4 or 8 steps with either high or low range.

COUNTERBORE

Low speeds down to 185 R.P.M. for use in counterboring holes in tough steel without burning tools.





TAPPING

Built-in tapping attachment for production tapping up to 5/8"-11 pitch in mild steel.

• Built sturdy for continuous production work yet with accuracy for the finest toolroom work, Footburt sensitives are all around favorites for small hole drilling. The wide speed range with backgear units from 185 to 2300 or from 277 to 3400 RPM makes it adaptable for drilling small holes in brass or aluminum or for counterboring holes up to $1\frac{1}{16}$" in tool steel.

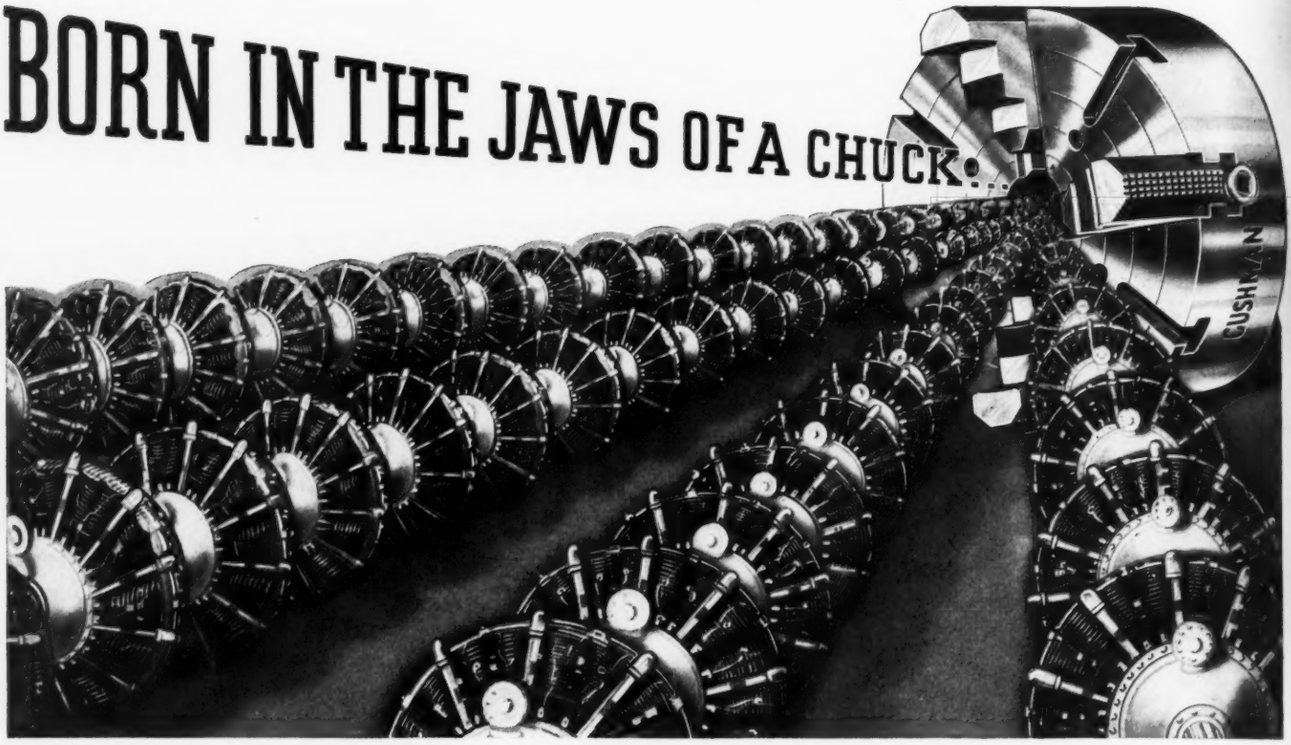
THE FOOTE-BURT COMPANY

CLEVELAND, OHIO

Detroit Office: 4-253 General Motors Bldg.

FOOTBURT *Sensitive* DRILLING MACHINES

BORN IN THE JAWS OF A CHUCK...



ALL PRECISION and a yard wide

IF YOU are a manufacturer of aircraft engines, Cushman Chucks are helping you to keep 'em coming and "keep 'em flying". Cushman Precision and Cushman ability to "take it" from three shifts of hard-driving operators are helping you to keep ahead of stepped-up production schedules.

This may be the first time you have really used the great reserve of strength and sustained accuracy built into every Cushman Chuck. And we consider it part of our contribution to the winning of this war to help you get both maximum production and maximum service life from your chucking equipment.

We will be glad to send you a supply of "Chuck-Check" maintenance cards for distribution in your plant. You may find them particularly useful in training new operators.

The Cushman Chuck Company, Hartford, Connecticut.

A WORLD STANDARD FOR PRECISION

CUSHMAN

CHUCKING ENGINEERS ★ SINCE 1862

These MAKE MOTOR-DRIVE *MORE THAN* POWER!

- *Motor-drive provides within itself a means of:*

Speed Control	Reversing
Braking	Remote Control
Tandem Operation	Controlled Acceleration
Tension Control	Safety

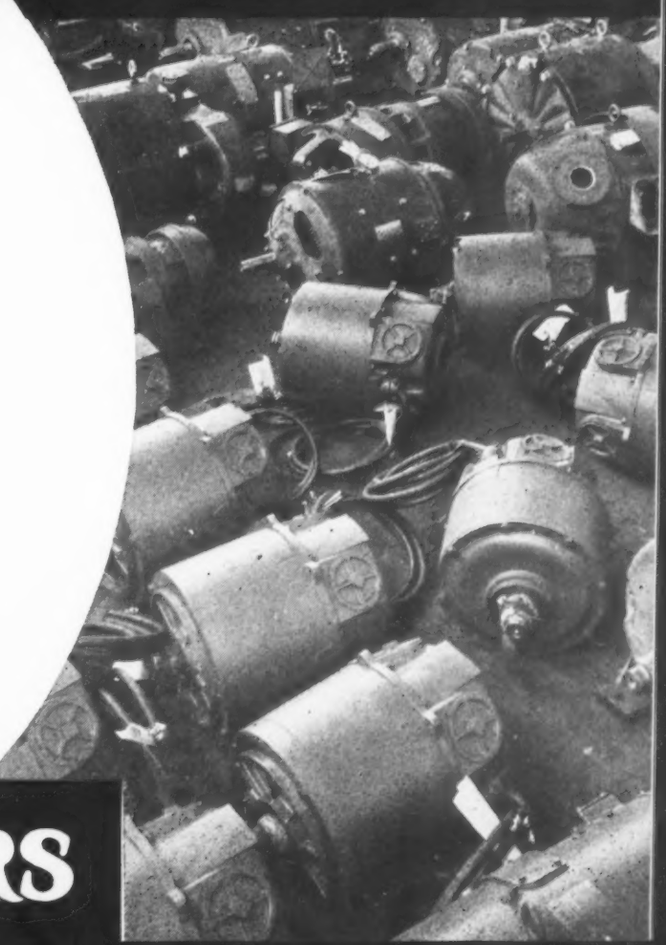
Slow Speeds for inching, threading, inspection

Applying them to boost production and improve quality is APPLICATION ENGINEERING. That's our business.

In process just behind these windows are armature coils, field coils, stator coils, all in great variety—evidence that the Reliance Motors of which they will be a part are designed to perform many functions besides turning shafts and gears. Motors will fit the job. They are going to users who started their machine design and production plans with the question, *"What can we get the motor to do besides supply power?"* Help in answering this question can be given by Reliance men trained to think of motor-drive in terms of production. There's no obligation involved in asking us to sit in with you and talk it over.

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 IVANHOE ROAD • • • CLEVELAND, OHIO

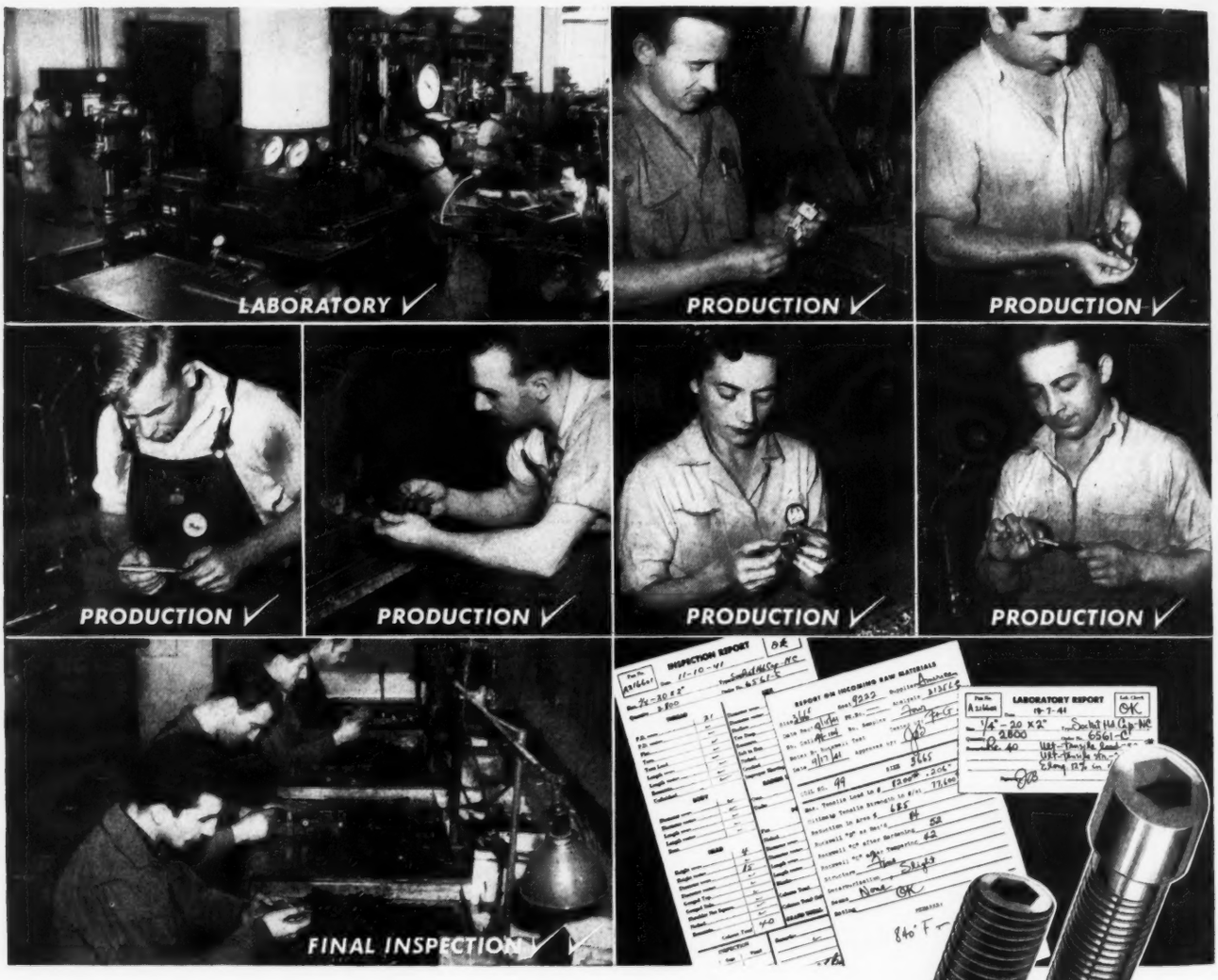
BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE, S. C. HOUSTON, TEXAS • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. • AND OTHER PRINCIPAL CITIES



RELIANCE A-C D-C MOTORS

Checked and Rechecked

To Insure Time-saving Performance!



Parker-Kalon Socket Screws undergo a rigid check-up routine that can only result in time-saving performance

A Quality-Control routine – without counterpart in the screw industry – weeds out screws that fail to meet the high standards of quality established by Parker-Kalon. This check-routine begins with careful analysis of the raw material and follows through to the final manufacturing operation. It gives Parker-Kalon Socket Screws a degree of dependability that helps to make every working hour count in scores of war production plants, yet it costs no more to specify *Parker-Kalon!* Parker-Kalon Corp., 202 Varick Street, New York, N. Y.

Quality-Controlled

Complete test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth, and centricality; Thread fit. Every detail is double-checked to assure the highest degree of workability.

PARKER-KALON
Quality-Controlled
SOCKET SCREWS
Give the Green Light to War Assemblies

Fractional Grades — Controlled Porosity — H9 Vitrified Bond – new improved hydraulic presses — additional scientifically controlled tunnel kiln — constant, rigid laboratory check of raw materials . . . These important steps by BAY STATE assure you of a continued supply of only "thoroughbred" abrasive products to help win your race for better delivery dates and our ultimate Allied victory.

A 64-page booklet containing a wealth of data on grinding wheels and other abrasive shapes is yours for the asking.

BAY STATE

ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

SUNNEN Solves Another Problem

The Job

Collet — .305" hole, hardened. Stock removed .002". Tolerance — Minus .000" plus .001". *Finish* — 2 to 3 micro-inches — practically all parts tested on Brush Surface Analyzer for micro finish and inspected under Comparator. Previous method used — hand lapping.

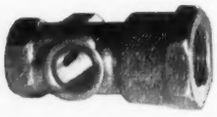
Time saved by Sunnen Honing — 35%.

"Since installing our first Sunnen Honing Machine we have constantly added more and more parts to pass through the honing process. We now have six machines in use."

— Fidelity Machine Company

SUNNEN HONING provides a finish of 2 to 3 micro-inches — and at a saving of 35% in time!

Airplane Engine Parts accurately honed to a super-smooth finish.



Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.

"Produced an extremely accurate and glass-like finish."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Accuracy — and a super-smooth finish with a real increase in production which means a saving in cost. That's the record of the Sunnen "MA" Precision Honing Machine in the modern plant of the Fidelity Machine Company.

This one example is indicative of the many reasons why hundreds of leading manufacturers handling important war contracts have adopted Sunnen Honing.

Consider These Advantages

Wide range — handles internal diameters of .185" to 2.400". Accuracy within "one-tenth" guaranteed — has been held to .000025" on production jobs. Relieves big internal grinders for other jobs. Corrects errors of out-of-roundness or taper caused by previous operations. Facilitates duplication of sizes. Does not require skilled labor. Practical — inexpensive — economical to operate.

Put Sunnen Honing to work in *your* plant!

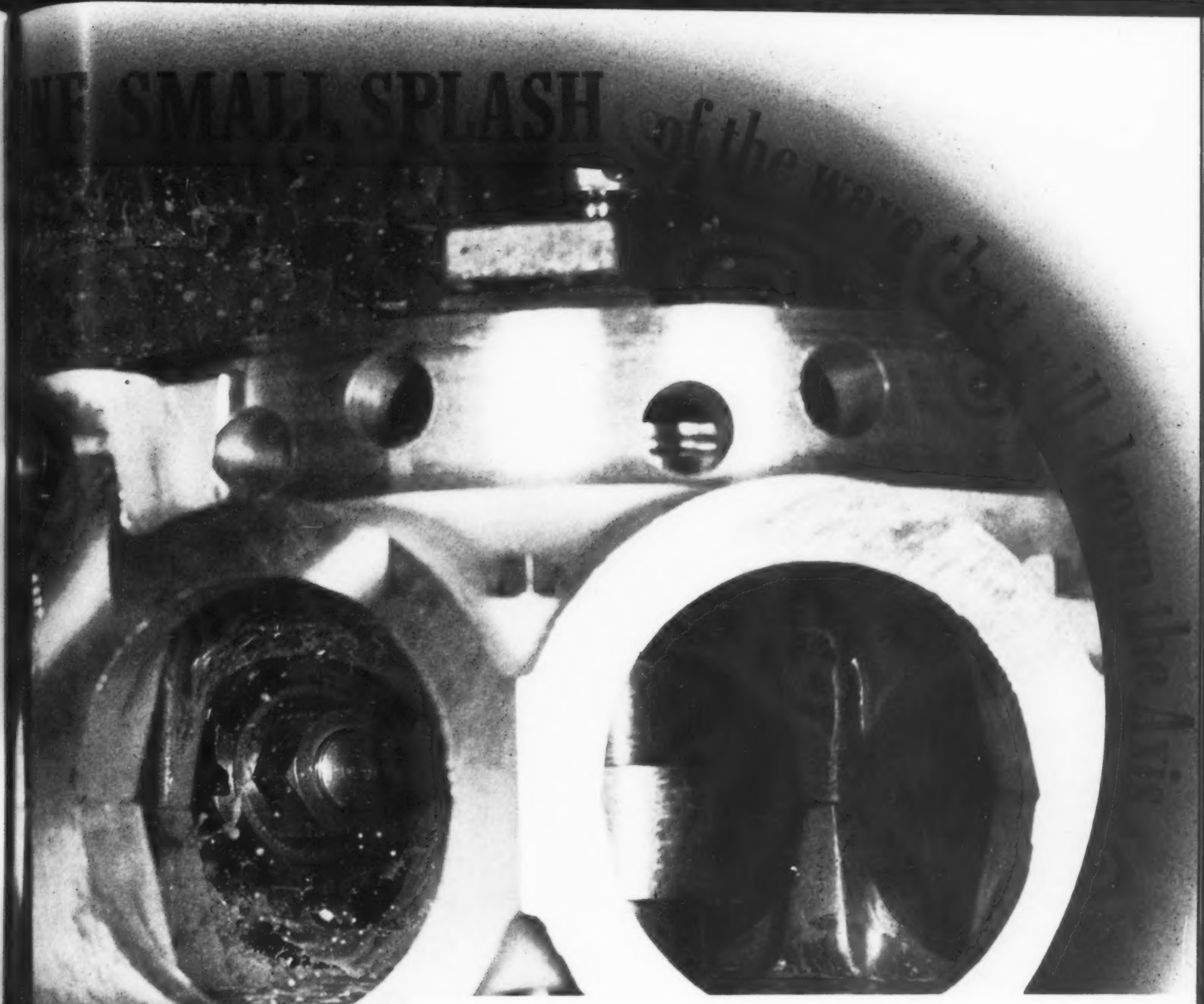
SUNNEN PRODUCTS CO., 7940 Manchester Ave., St. Louis, Mo.

Canadian Factory, Chatham, Ontario

Send for FREE BULLETIN

— Giving complete information. Or, if you prefer, a Sales Engineer will call and demonstrate this equipment in your plant, on your job.

SUNNEN



PEEKING at you through the left porthole is a P&W cutter on the job. The work — an aircraft engine crankcase — stands still. The cutter makes its way around the face of a cylinder hole, slicing it down to design size with precision and dispatch.

As you'll judge from the flying coolant at the upper left, this is one of the splashiest jobs in metal working — which indicates the cutting speed and power of this P&W cutting tool.

Wherever *accurate* cutting is vital in American industry, P&W cutters, taps, dies, reamers, and end mills now are pounding out production 24 hours a day . . . hastening the time when we'll return a solid sock in the face for that slinking stab in the back.

Don't spare the pressure. Your P&W tools can take it.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

SUPREMACY IS IN THE AIR!

In that great new eagle's nest of aviation . . . the Ford Aircraft Engine Plant . . . production is far ahead of schedule.

Engines . . . made with watchmaker's precision . . . are coming from assembly lines in heart-warming succession.

In explaining the secret of this record-making production, no small credit is given to air-control in the plant itself.

Day and night . . . 4000 tons of York refrigeration equipment maintain constant temperature throughout the plant . . . help to step up production by reducing scrap loss on precision work. Raw materials...work in progress...tools...gauges maintain unvarying dimensions in even temperature. Expansion and contraction are not given a chance to cause faulty machining.

This is just one striking demonstration of air-control as a powerful ally in precision mass production.

York Ice Machinery Corporation, York, Pennsylvania.

Released for publication by the United States Army

★

YORK REFRIGERATION AND AIR CONDITIONING

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

(UPPER PICTURE)
Checking dimensions of Trunnion Bearing Boxes with a Starrett Micrometer No. 224 and Vernier Height Gage No. 454. Photos courtesy of Goss Printing Press Co.

(LOWER PICTURE)
Surfaces are scraped to limits of plus or minus 0.001"—an operation that calls for frequent checking with precision measuring tools. The operator in the background is using a Starrett Vernier Height Gage with Starrett LAST WORD Indicator attached. Starrett Dial Test Indicator No. 665 is shown in the foreground.

These scenes in the plant of the Goss Printing Press Co. show skilled American workmen building heavy caliber anti-aircraft guns for the U. S. Navy...a job that has already won the coveted Navy "E" pennant for excellence. In this plant, as in most plants throughout the "Arsenal of Democracy," Starrett Precision Measuring Tools are helping to maintain the highest standards of accuracy . . . helping to produce more and better planes, tanks, ships and guns for the fighting men of America.

THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U. S. A.

World's Greatest Toolmakers

STARRETT TOOLS

One Hand Driving • Power Tools • Tighter Assembly = 50% Less Assembly Time with Phillips Screws

B. P. (Before Phillips). Slow-driving slotted screws required two hands to aim the screw and steady the work — and still accidents happened, causing plenty of mangled fingers or scars in the work. Always something going wrong — crooked screws — heads splitting — burrs to remove — loose assemblies. Thank goodness those days are gone forever!

A. P. (After Phillips). Faster-driving Phillips Recessed Head Screws need only one hand . . . the other hand is free for support. No fumbled screws — straight, effortless driving. Even when assembling parts already finished — like enameled, painted or other easily-scratched surfaces — power driving is safe, because there's no danger of driver slippage. And screws can be set up tight without heads splitting or raising burrs.

Your assembly crew will find it "easy as rolling off a log" to produce better work . . . in half the time . . . at a 50% cost saving with Phillips Screws.

For facts and screws write any firm listed below.

PHILLIPS RECESSED HEAD SCREWS

GIVE YOU 2 for 1 (SPEED AT LOWER COST)

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

BOOST "MACHINE MORALE"

MORSE

TWIST DRILL AND MACHINE COMPANY

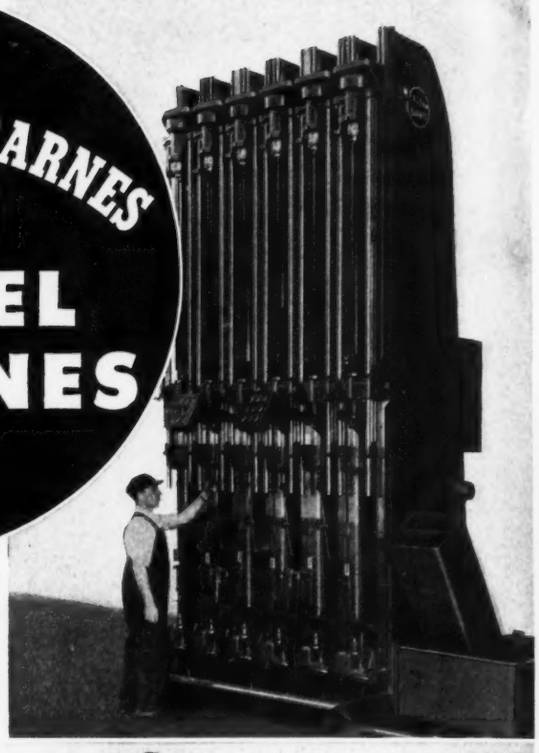
NEW BEDFORD, MASS., U. S. A.

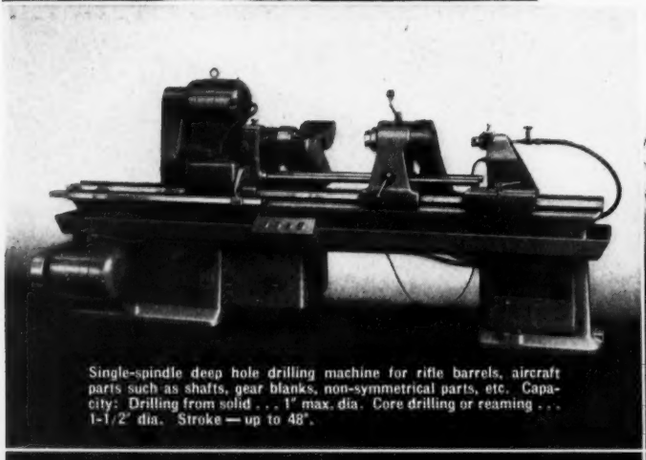
NEW YORK STORE: 130 LAFAYETTE ST. - - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

W. F. & JOHN BARNES GUN BARREL MACHINES

Six-spindle vertical rifle barrel drilling machine for .30 and .50 calibre rifle barrels.

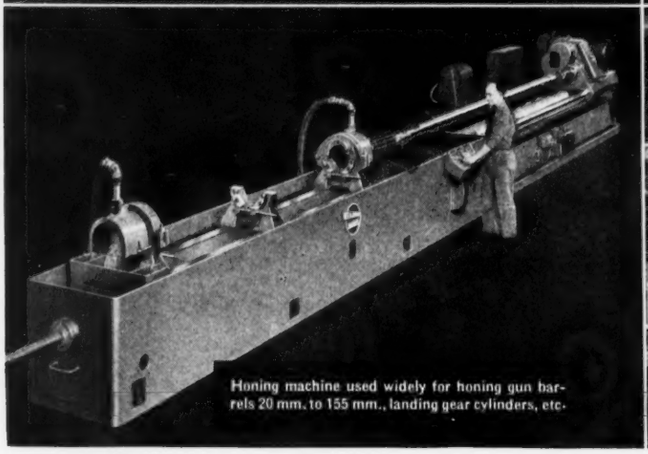
Six-spindle vertical deep hole drilling machine for drilling 20 mm. gun tubes from solid.





Single-spindle deep hole drilling machine for rifle barrels, aircraft parts such as shafts, gear blanks, non-symmetrical parts, etc. Capacity: Drilling from solid . . . 1" max. dia. Core drilling or reaming . . . 1-1/2" dia. Stroke — up to 48".

Two-spindle deep hole drilling machine for .30 and .50 calibre rifle barrels, non-symmetrical parts, diametrically balanced parts such as cam and crankshafts, boring bars, etc. Stroke — up to 48".



Honing machine used widely for honing gun barrels 20 mm. to 155 mm., landing gear cylinders, etc.

Two-spindle deep hole drilling, boring, and reaming machines. Capacities: — Drilling from solid — 1" to 5" dia. Stroke — up to 16'.

W. F. & JOHN BARNES

FREE

● Descriptive literature on any of the machines shown here will be sent promptly upon request.

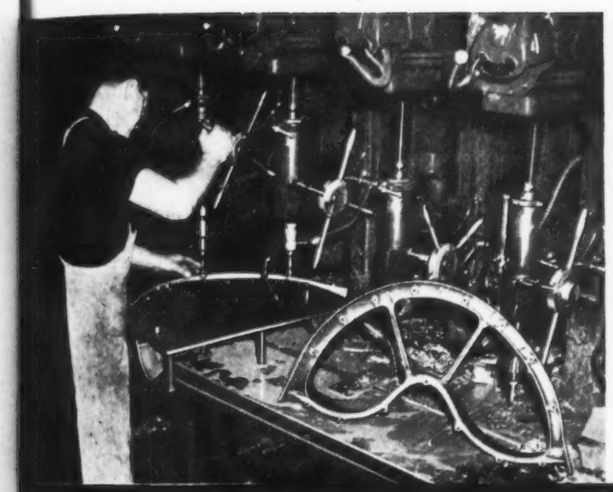
New Free Guide for grinding .30 and .50 Calibre Rifle Drills by hand also available,— send for your copy today.

W. F. and JOHN BARNES

320 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

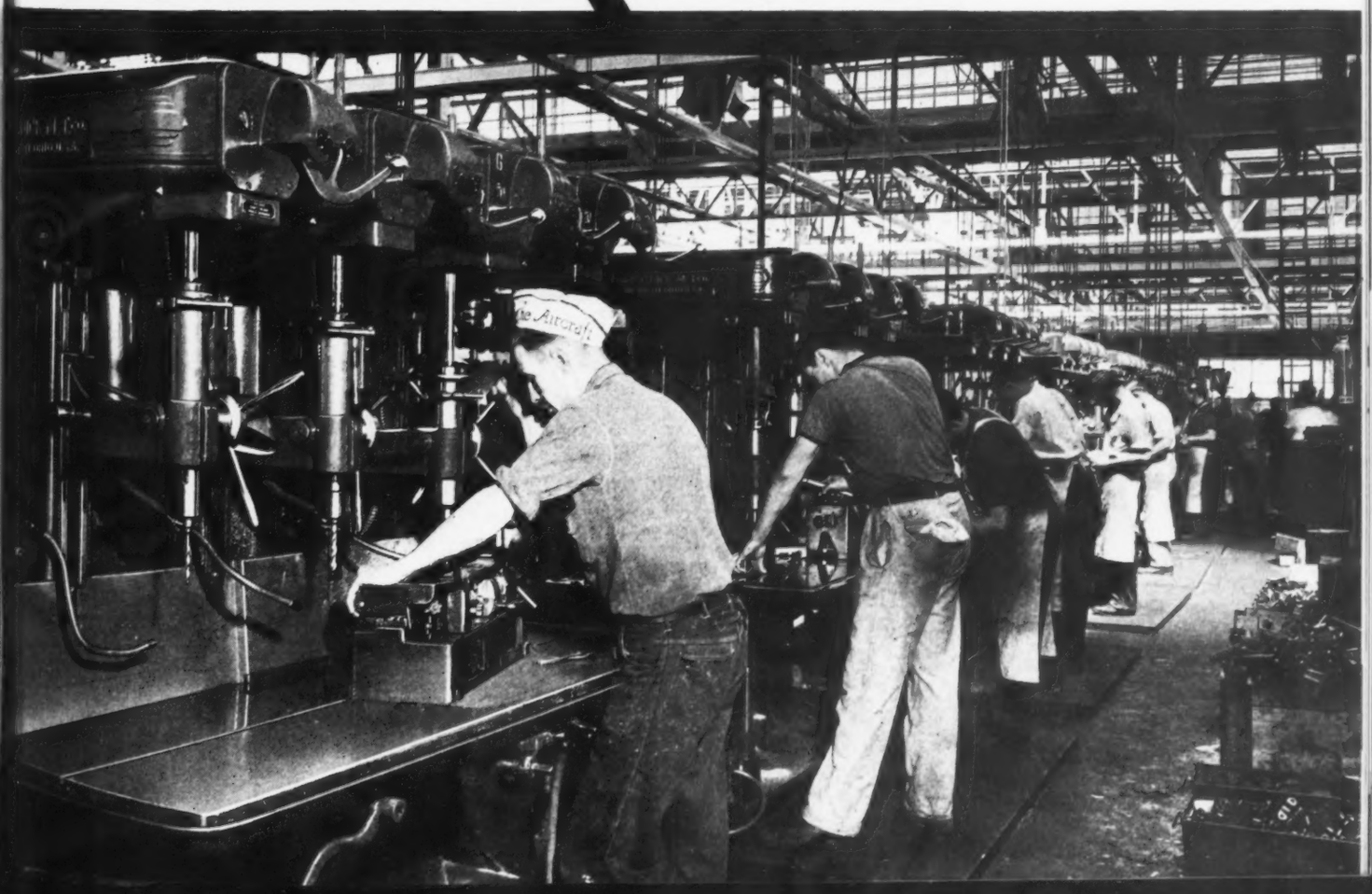
FOSDICK Sensitive Drills

DRILL • REAM • TAP
INTRICATE AIRPLANE PARTS

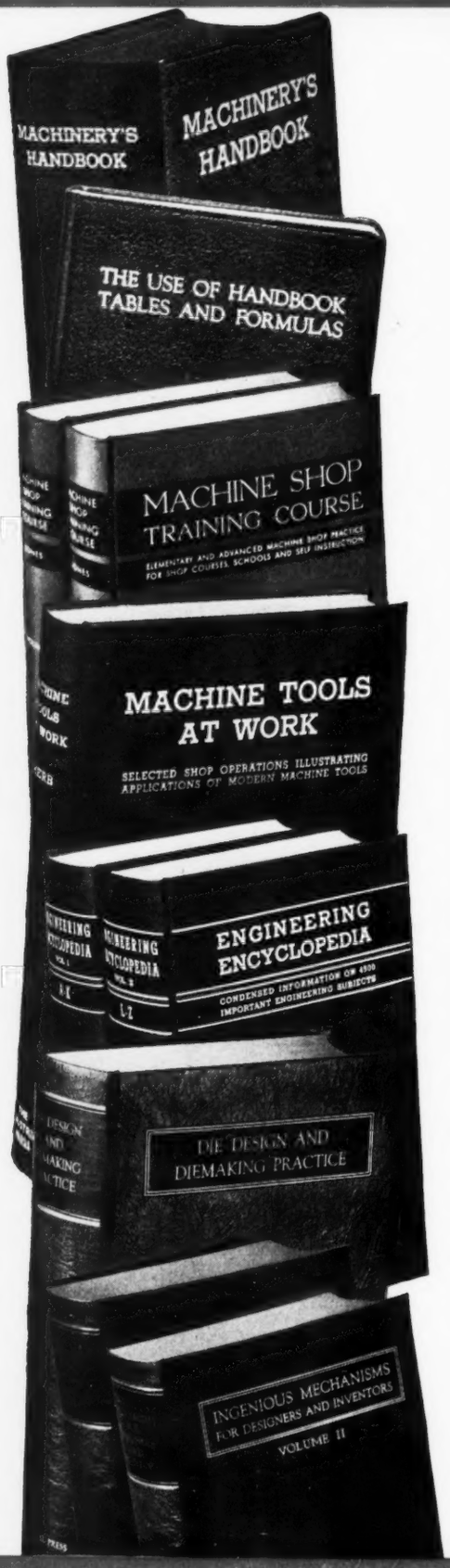


At an Airplane Division plant of the Curtiss-Wright Corp., leading edges for ce[illegible]ings for the world's fastest pursuit ships are drilled, reamed and tapped on Fosdick four-spindle Sensitive Drills as illustrated. Being odd-shaped, the work is held in a jig plate with shop rests so that it can be easily moved to desired positions. Four different sizes of drills are used, two reamers and two taps to produce the finished parts at an unprecedented rate. This is one application of Fosdick equipment at this plant, and a battery of Fosdick drills, employed to machine numerous [illegible] shown below. These "action shots" are evidence of Fosdick "rates", of how Fosdick meets unusual and high speed production demands. Bulletin upon request.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI • • • OHIO



STANDARD ENGINEERING BOOKS


MACHINERY'S HANDBOOK
MACHINERY'S HANDBOOK
THE USE OF HANDBOOK TABLES AND FORMULAS
MACHINE SHOP TRAINING COURSE
MACHINE TOOLS AT WORK
SELECTED SHOP OPERATIONS ILLUSTRATING APPLICATIONS OF MODERN MACHINE TOOLS
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INGENIOUS MECHANISMS FOR DESIGNERS AND INVENTORS
VOLUME II

MACHINERY'S HANDBOOK
World-renowned book for mechanical engineers, machine designers, toolmakers, and machinists. Contains engineering and manufacturing standards, machine shop data, rules, formulas, and general information for designers and builders of everything mechanical. Eleventh Edition, 1815 pages, 1310 illustrations. Price, $6.00.

THE USE OF HANDBOOK TABLES AND FORMULAS
A companion book for users of MACHINERY'S Handbook, showing how to get the most out of your Handbook. Contains numerous examples with solutions and test questions indicating typical applications of Handbook matter. 203 pages, 63 illustrations, 500 problems, practice exercises, test questions and answers. Price, $1.00.

MACHINE SHOP TRAINING COURSE
In two volumes, covering both elementary and advanced machine shop practice for shop courses, technical schools, and self instruction. Packed with **practical** information. 1088 pages, 524 illustrations. Volume 1 includes a series of simplified blueprint reading charts in color. Complete two-volume course, $6.00; either volume separately, $4.00.

MACHINE TOOLS AT WORK
Selected shop operations illustrating applications of all classes of modern machine tools. Contains 544 pages and 434 close-up action photographs illustrating outstanding jobs from all types of shops. This book is equivalent to a mechanical sight-seeing tour through the best shops in the United States. Price, $4.00.

ENGINEERING ENCYCLOPEDIA
A general engineering reference book and mechanical dictionary combined. Contains essential facts about 4500 standard and special engineering subjects. The two volumes contain 1431 pages of concise treatises and informative definitions of engineering and mechanical terms. 206 illustrations. Price, $8.00.

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A book for die designers and diemakers, containing 956 pages of actual examples of approved die construction, including all types of blanking, forming or drawing dies for sheet metal parts. The information throughout was obtained from die specialists. 590 die drawings included. Price, $6.00.

INGENIOUS MECHANISMS
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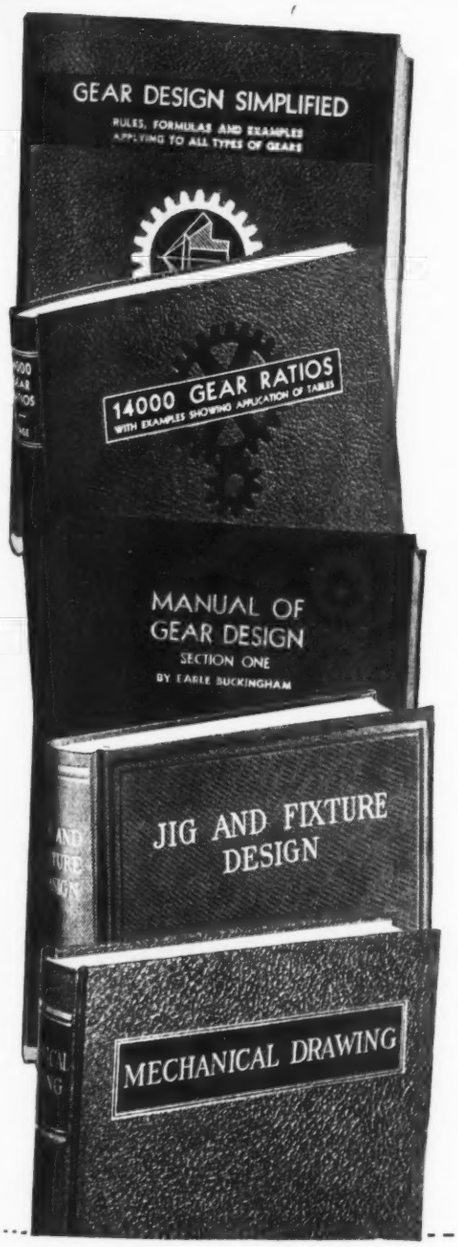
For designers and builders of mechanical products

STANDARD ENGINEERING BOOKS


GEAR DESIGN SIMPLIFIED
RULES, FORMULAS AND EXAMPLES APPLYING TO ALL TYPES OF GEARS
14000 GEAR RATIOS
WITH EXAMPLES SHOWING APPLICATION OF TABLES
MANUAL OF GEAR DESIGN
SECTION ONE
BY EARLE BUCKINGHAM
JIG AND FIXTURE DESIGN
MECHANICAL DRAWING

GEAR DESIGN SIMPLIFIED

Book of working rules and formulas covering the design of various types of gears. It contains 110 gear-problem charts with 201 drawings illustrating all kinds of gear-designing problems and includes a lot of information required in the shop. Worked-out examples show how rules or formulas are actually applied. Price, $3.00.

14000 GEAR RATIOS

Tabulated ratios presented in both common fractional and decimal forms and in four differently arranged sections to facilitate the solution of all classes of gear-ratio problems. Typical examples show how the tables are applied. Contains 14000 two-gear and millions of possible four-gear combinations. 404 pages. Price, $5.00.

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JIG AND FIXTURE DESIGN

Deals with the principles underlying the development of various classes of jigs and work-holding fixtures, and contains illustrations of many of the most ingenious designs used in modern shops. Shows numerous types of jigs for drilling, boring, planing and milling, etc. 350 pages, 297 illustrations. Price, $3.00.

MECHANICAL DRAWING

Treatise on the drawing of machine details, including the making of different classes of drawings; dimensioning, reading, and checking of working drawings, with additional information on numbering and filing systems for drawings, and general drafting-room practice. 342 pages, 179 illustrations. Price, $3.00.

THE INDUSTRIAL PRESS, 148 Lafayette St., New York

Send me, postpaid, the following books, or book. I enclose (1) payment in full. (2) or a first payment of one-third the total amount due, balance payable in monthly installments. I have the right to return any book within 5 days and money will be refunded.

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A profitable investment in practical knowledge

A flexible machine that is the last word in simplicity of operation

HI-SPEED HONING and LAPPING MACHINE

for use with any standard make honing head

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"...Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) . . Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) . . Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2⅜"	2¾"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44"x60"	60"x80"	60"x80"	60"x108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

Discuss your Cutting Oil Problems with a Cities Service Lubrication Engineer!

Due to war production and priorities, many manufacturers today are using new and unfamiliar materials—and each presents a new and unfamiliar cutting oil problem.

Unless these problems are solved quickly and economically, they can cost you real money in lost time, damaged equipment and poor results.

Why not have a Cities Service Lubrication engineer go over your cutting oil problems? You'll find he has up-to-the-minute information that can help you get maximum production . . . maximum tool life . . . and a better finish.

This friendly personal service is yours without cost or obligation. All you need to do is write on your own letterhead to the nearest Cities Service office listed below.

We shall be glad to send you an informative booklet, "Metal Cutting Lubrication." Just check the space indicated!

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.

or any of the following offices:
CHICAGO · CLEVELAND · ST. PAUL
KANSAS CITY · BOSTON · TORONTO

or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT · ATLANTA · BIRMINGHAM

Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet, "Metal Cutting Lubrication." ☐ M.

Name_____

Firm Name_____

Address_____

City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED

MACKLIN GRINDING WHEELS

TOPS for thread grinding

In hundreds of production plants *MACKLIN* THREAD GRINDING WHEELS have been found to be most efficient. On practically every job a *MACKLIN* resinoid thread grinding wheel has solved the problem. Grain size depends on type of thread and finish required. Proper wheel and work speeds are very important. A *MACKLIN* FIELD ENGINEER will be glad to assist you upon your request.

"PROTECT Your PRODUCTION"

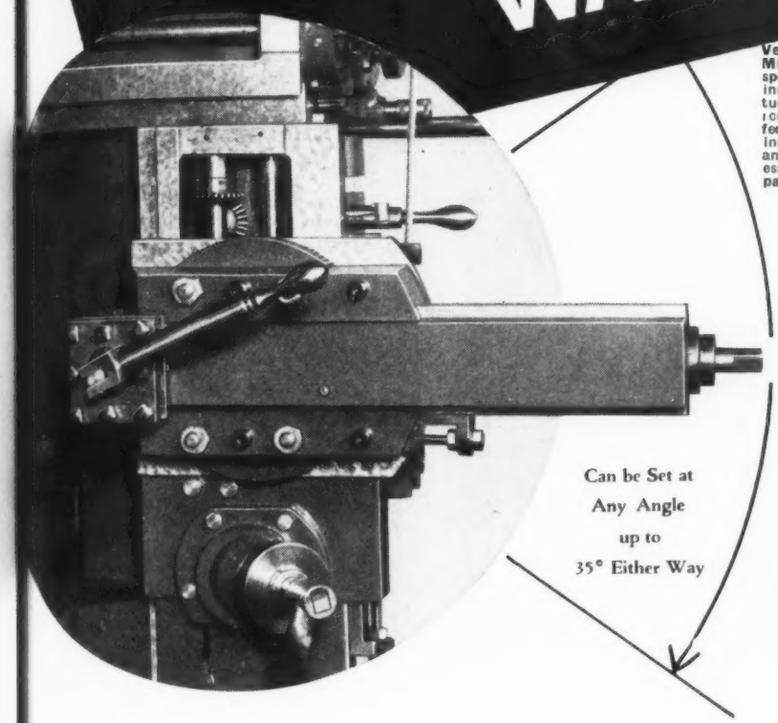
MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

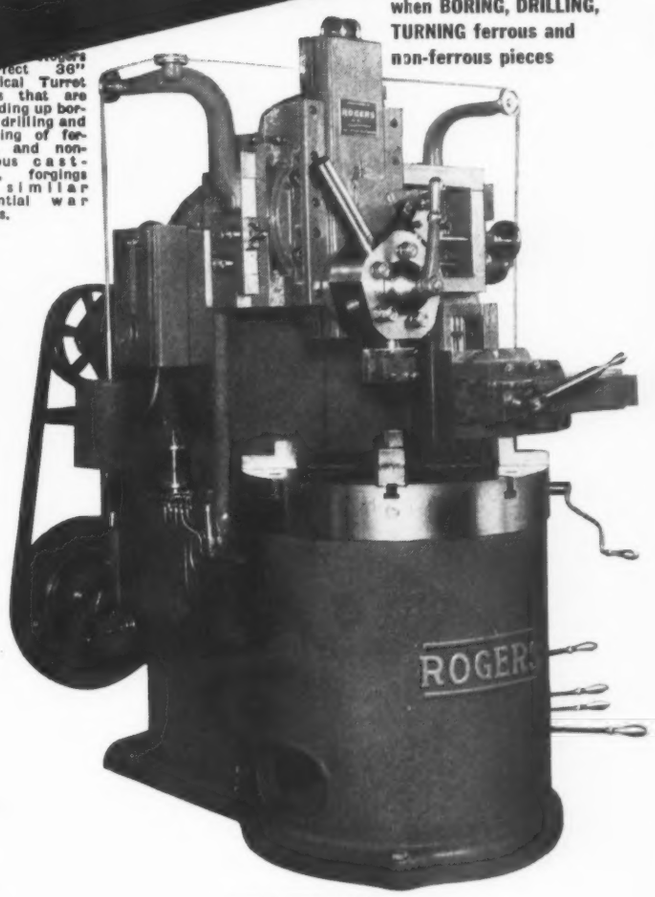
HOW ROGERS *Specially Designed* SWIVEL SIDE HEAD WILL STEP UP YOUR WAR PRODUCTION



Can be Set at Any Angle up to 35° Either Way

Rogers "Perfect 36" Vertical Turret Mills that are speeding up boring, drilling and turning of ferrous and non-ferrous castings, forgings and similar essential war parts.

when BORING, DRILLING, TURNING ferrous and non-ferrous pieces



ROGERS "Perfect 36" VERTICAL TURRET MILLS universal adaptability is further increased by the Rogers Swivel Side Head. This new development permits the side head to be set at *any angle* each side of vertical up to 35 degrees to facilitate tool setting for irregular shaped pieces.

Built-in graduated dial saves time in making set-ups for original and second runs.

This swivel side head combined with level chuck are a couple of the many reasons operators make *quicker set-ups . . . more finished* work . . . and *closer tolerances* in a minimum amount of operator's time and equal reduction of "down time."

Call on Rogers today and tomorrow to "Machine It on the Level."

FEATURES

Self-contained compact design for quicker set-ups and more accurate finished work.
Adjustable swivel head — set at any angle up to 35 degrees each side of vertical.
Horizontal 4-jaw chuck with 36" diameter capacity.
5-sided main turret and 4-sided side turret.
Rapid power driven traverse on main head.
Box type main and side head rail with saddle, swivel and tool stake.
6⅜" diameter spindle with 175 sq. in. V-shaped bearing 14⅞" in diameter.
Foot operated controls.
Multi V-belt main drive with adjustable take-up.
1150 RPM motor drive with 7½ HP constant duty motor main drive and ½HP motor for rapid traverse.
Standard and high speed models.

KNOWING HOW SINCE 1885

ROGERS IS MAKING SURPRISINGLY GOOD DELIVERIES AT ATTRACTIVE PRICES

ROGERS MACHINE WORKS INC.

FACTORY: ALFRED, N. Y.

SALES OFFICES: 133 ARTHUR ST., BUFFALO, N. Y.

parts remain

bright

AS A NEW PENNY

thanks to Tide Water Cutting Oil

No more time out between runs for cleaning machines and changing oil when production shifts from steel to brass to aluminum – not since Tide Water Cutting Oil went to work in this plant. No more squawks from the plating department about tarnished parts. Over five years performance on precision machining work in this plant has shown that Tide Water Cutting Oil keeps production at peak and machined parts "bright as a new penny."

This valuable aid to increased production is helping hundreds of busy plants achieve longer tool life, and fewer work interruptions. On a drawing operation with soft aluminum sheets, scrap loss dropped from 50% to 3% thanks to Tide Water Cutting Oil.

If lubrication or cutting problems are affecting your production schedules a Tide Water engineer can help you. He will recommend the Tide Water lubricant to fit your particular needs. For full information write today to Tide Water Associated Oil Company, 17 Battery Place, New York.

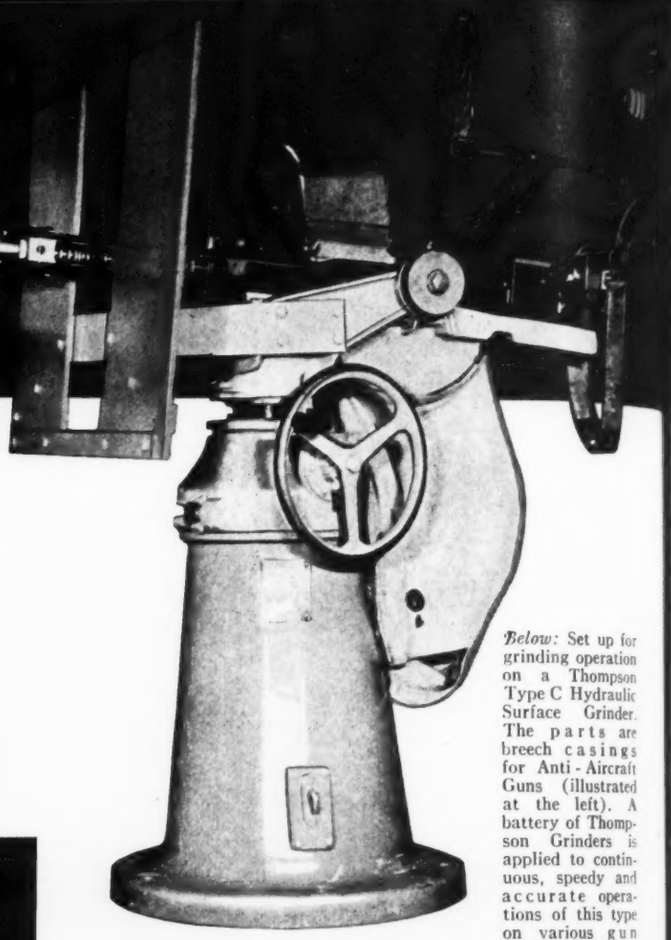
DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

INDUSTRIAL TYCOL OILS-GREASES

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N.C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

The speedy way to **GRIND** *gun parts accurately*



Specifications for various parts for this type Anti-Aircraft Gun call for **extreme** accuracy . . . production demands **extreme** speeds . . . and Thompson Grinders fill the bill to perfection! Thompson Grinders, available in a number of sizes and models, feature the high set-up and operation speeds needed for war production of this nature, ofttimes speed-grinding to limits of less than .0001". Bulletins list all features in detail. Write to the Thompson Grinder Company, Springfield, Ohio.

Below: Set up for grinding operation on a Thompson Type C Hydraulic Surface Grinder. The parts are breech casings for Anti-Aircraft Guns (illustrated at the left). A battery of Thompson Grinders is applied to continuous, speedy and accurate operations of this type on various gun parts in this mid-western plant.

Thompson GRINDERS

HELP

FOR MECHANICS' BUSY FINGERS

Most mechanics prefer to run a cap screw down as far as possible with their fingers before applying a wrench. So, to provide a better grip, for years we have knurled the heads of "Unbrako" Socket Cap Screws. Even when screws are oily or fingers greasy, there is no skidding or slipping —lost time and wasted motion are eliminated . . . production is speeded up.

Don't overlook this aid to production . . . it costs no more. The "Unbrako" Catalog gives sizes and details . . . send for a copy.

STANDARD PRESSED STEEL CO.

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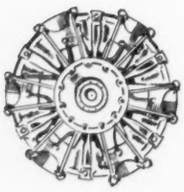
Knurling of Socket Screws originated with "Unbrako" years ago.



WANTED

50 PRODUCTION EXECUTIVES

Must be top-flight men of proven ability, capable of directing the many divisional operations of one of the world's largest aircraft-engine plants.

The Dodge Chicago Plant, division of Chrysler Corporation, now being built in the Chicago area, wishes to have associated with it a large group of men who have demonstrated their specialized talent, executive ability and high character.

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MACHINE—Gorton 9-J Super-Speed Vertical Mill with Duplicator Table and Tracer.

PART—Rear of Crankshaft—Steel.

CUTTERS—Special .738" dia. Ball Cutter—Profile Form Type—4 Flute.

HOLDING—Special Fixture.

FEED—Hand.

SPINDLE SPEED—500 r.p.m.

STOCK REMOVED—1/8".

FLOOR-TO-FLOOR TIME—15 Minutes.

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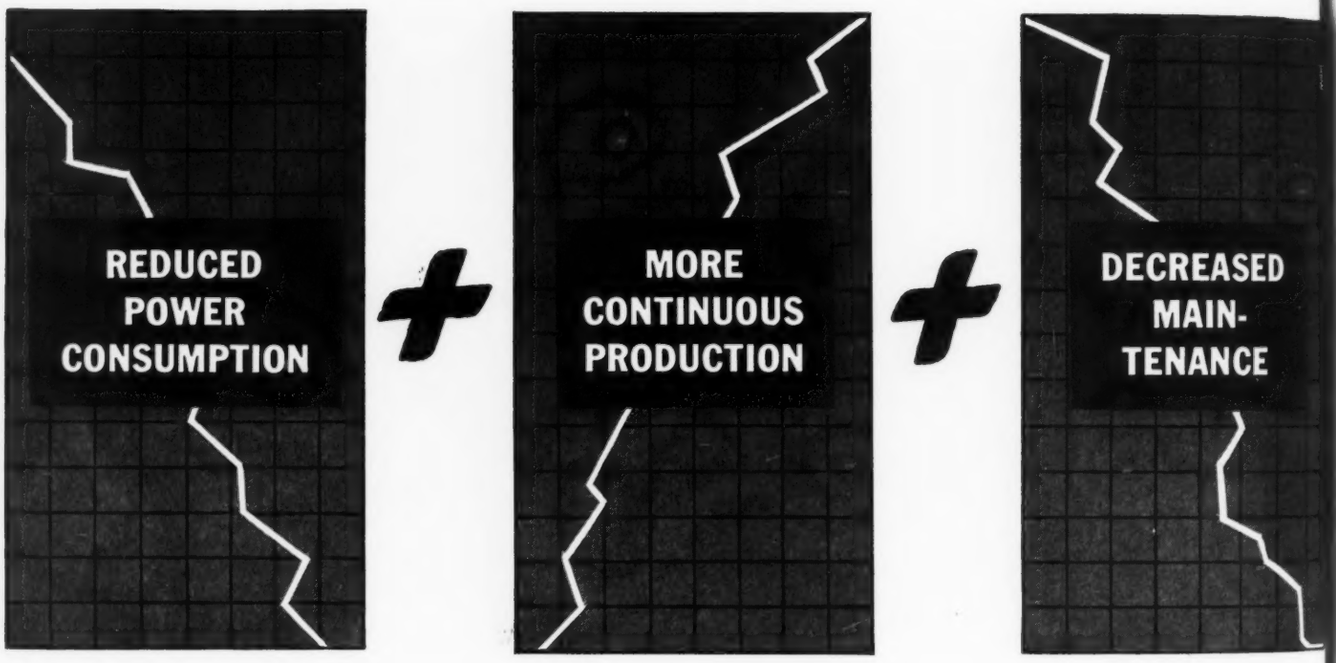

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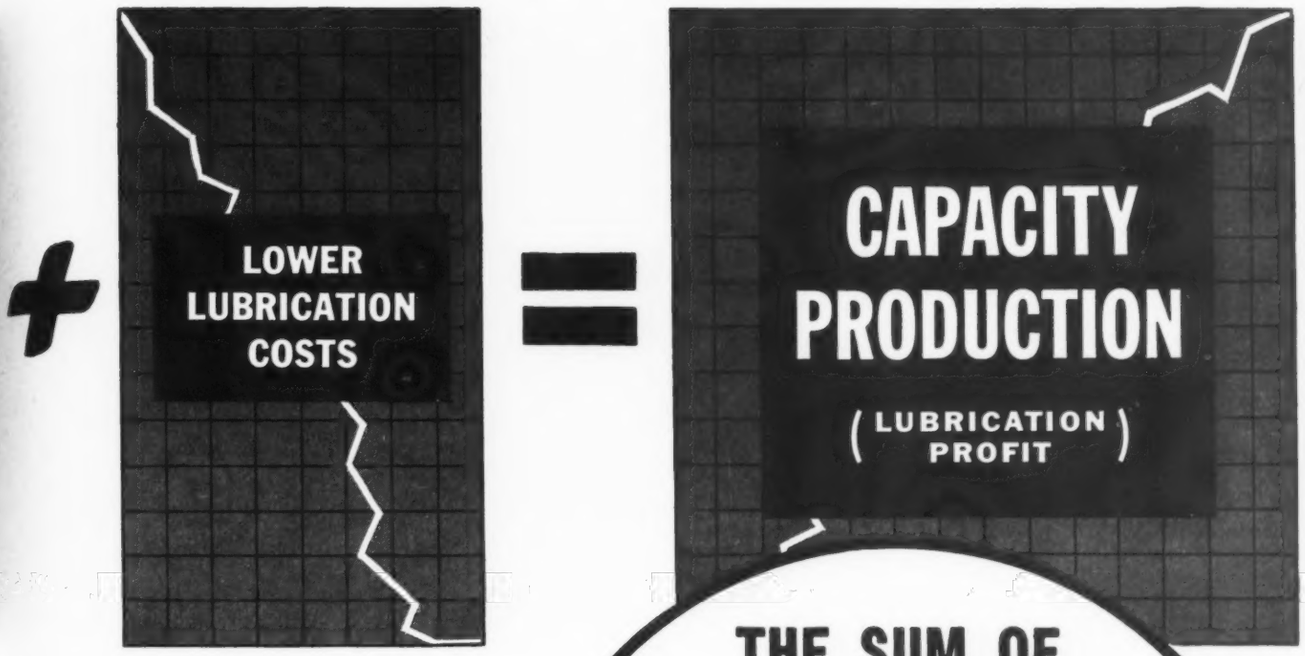

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You'll find you'll have fewer breakdowns, less frequent regrinds, and practically no downtime—AND MORE PRODUCTION. Due to the unique design of the blade, which provides the necessary side and back clearances, excessive friction is eliminated. Furthermore, the hollow-ground top of the blade permits the bursting chip to leave the cut without excessive friction.

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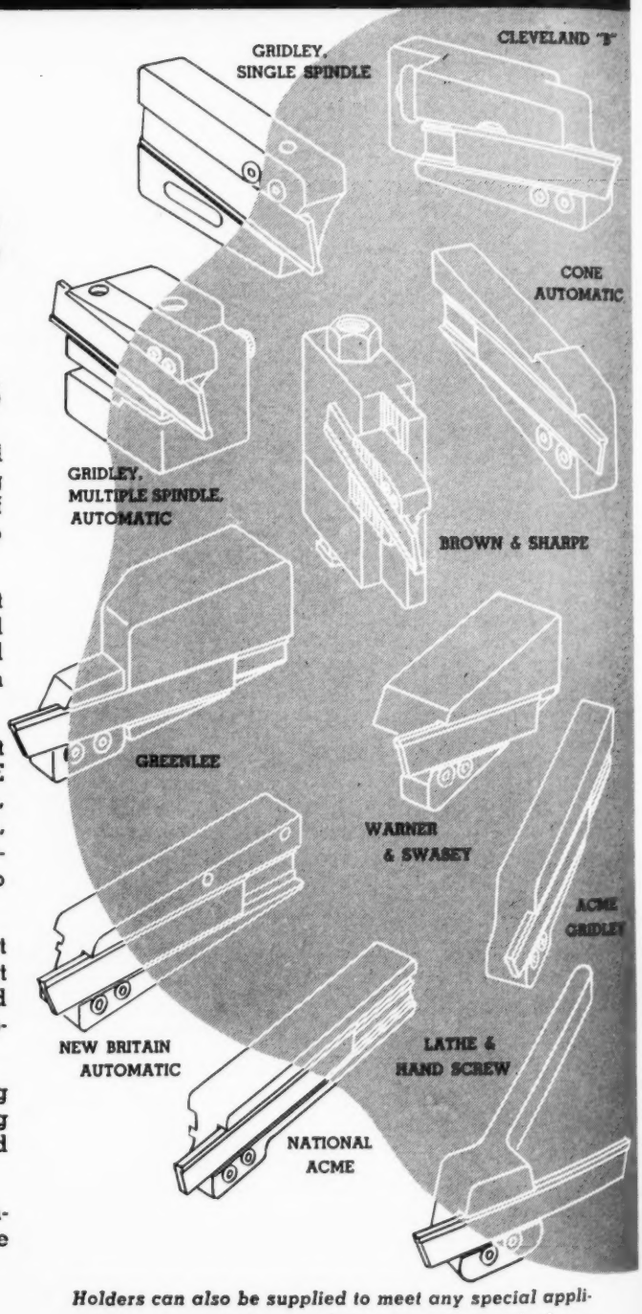

Holders can also be supplied to meet any special applications on any other machines not mentioned above.

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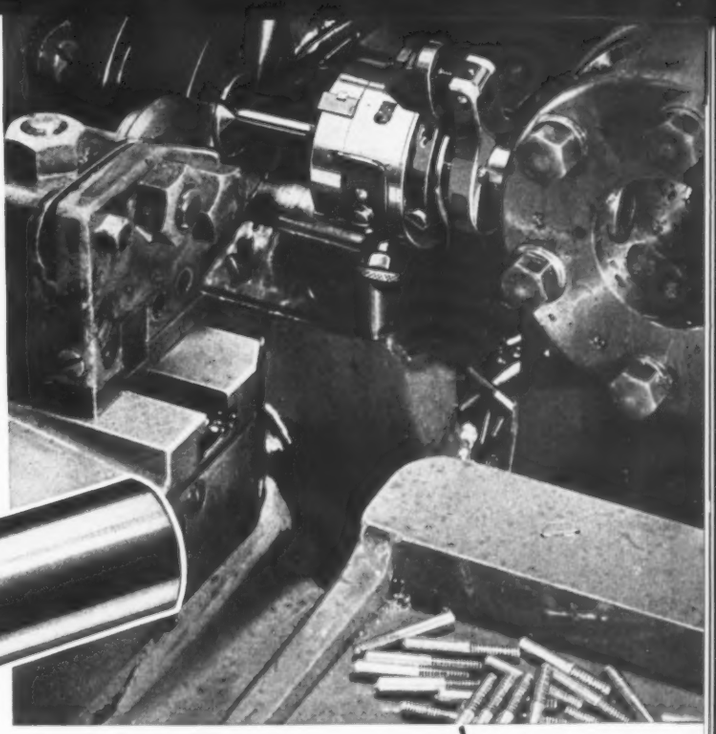
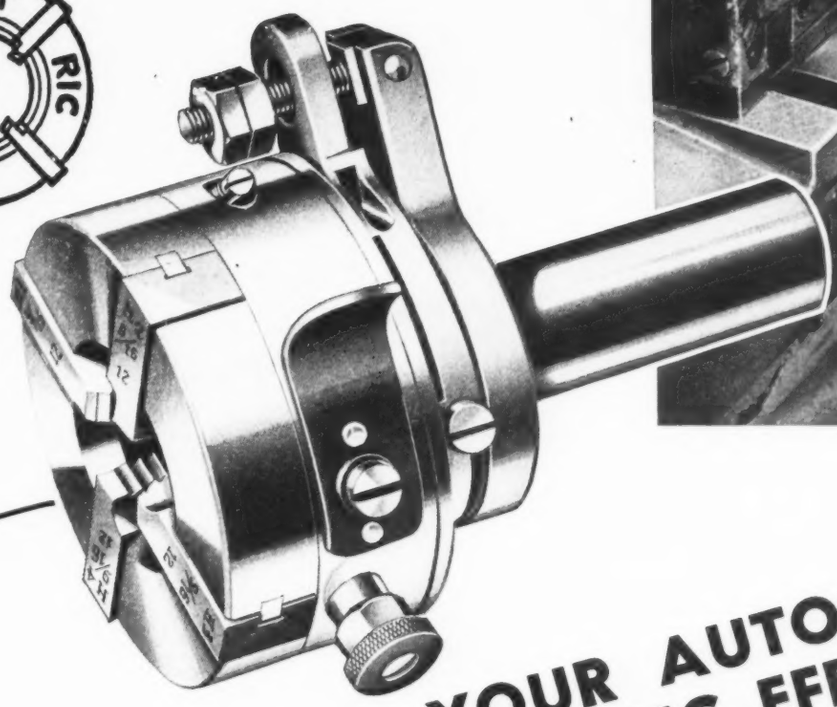
STYLE DS





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Forty-spindle Buhr Drilling and Reaming Head, designed for drilling and reaming all holes in Aircraft Motor Cylinder Heads. Vertical adjustment in Spindles, and the action of an oil pump for positive lubrication, facilitate production.

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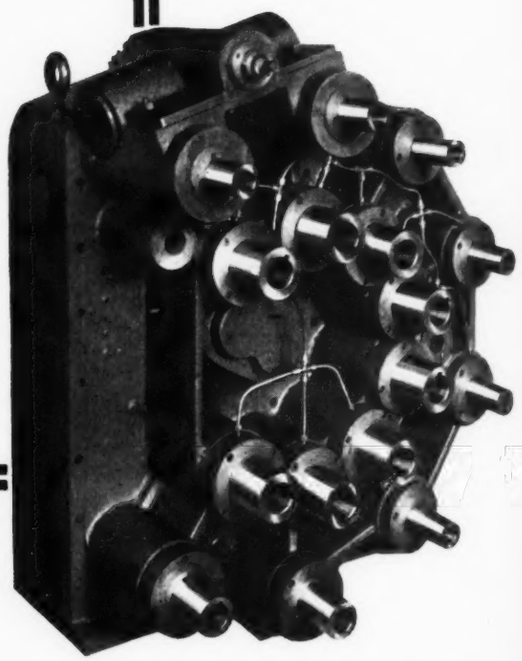

These two illustrations of specialized engineering indicate the production possibilities with Buhr-designed equipment applied to Aircraft manufacture. Send your blueprints for suggestions and recommendations on similar applications of Buhr-engineering for maximum efficiency in America's all-out efforts. . . .

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Keep all bearings clean and well lubricated. Exclude dust, dirt and moisture. Use only high-grade lubricants. Watch for the first signs of unusual heat or noise or looseness in the bearings. If possible, keep replacement bearings at hand, for a quick substitution if needed. America, in her vast war program, cannot afford to lose a single machine-hour of production. Guard against such losses by FREQUENT BEARING INSPECTION.

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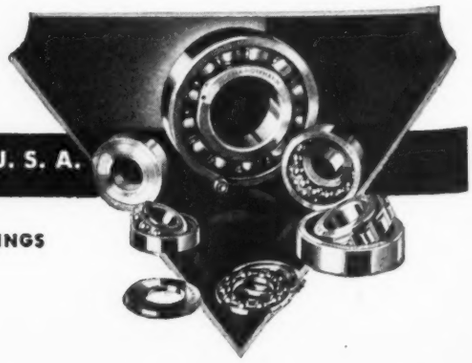
Write for the Catalog. Let our engineers work with you.



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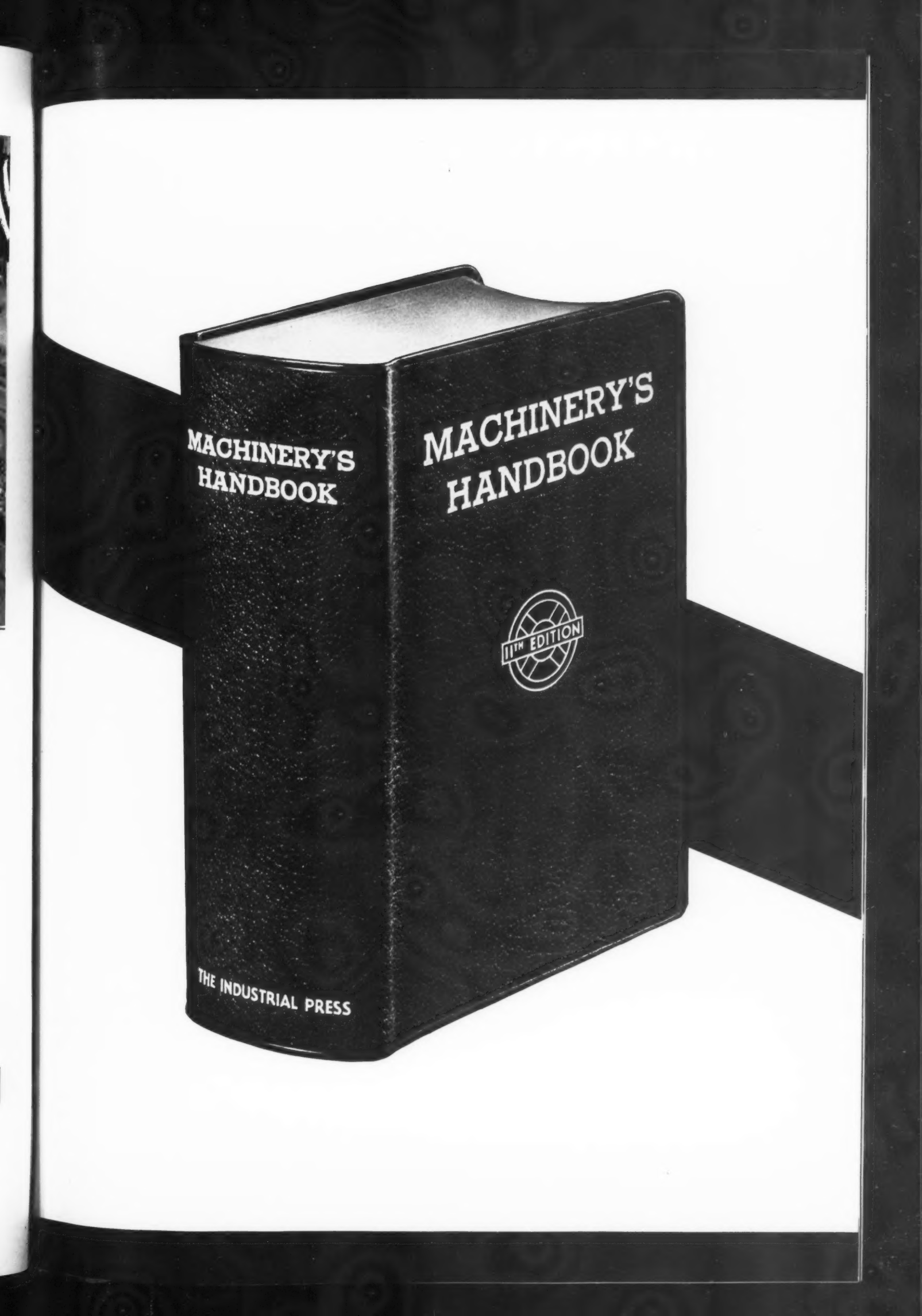
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11TH EDITION
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The Mechanical Industries Require This Information

Below is a list of 136 main subjects or divisions in the 11th Edition of MACHINERY'S Handbook. Any one of the thousands of items in these various sections may readily be located by referring to the very complete index. A special "thumb index" provides for opening the book instantly to any of 14 main divisions most frequently consulted.

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Squares and Polygons
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Percentage
Interest
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Arithmetical and Geometrical Progressions
Mathematical Signs and Abbreviations
Positive and Negative Numbers
Equations
The Slide-rule
Logarithms
Hyperbolic Logarithms
Calculation of Plane Figures
Calculation of Solids
Pappus or Guldinus Rules
Contents of Cylindrical Tank at any Level
Circles and Equivalent Squares
Solution of Triangles
Natural Trigonometric Functions
Logarithms of Trigonometrical Functions
Minutes and Decimals of a Degree
Geometrical Propositions and Problems
Composition and Resolution of Forces
Mechanical Powers
Center of Gravity
Moments of Inertia
Motion, Force and Work
Radius of Gyration
Centrifugal Force
Flywheels
Radians
Factors of Safety
Strength of Metals and Other Common Materials
Moments of Inertia Tables
Punch and Shear Frames
Properties of Shafts, Standard Pipe, and Structural Shapes
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Structural Timbers
Strength of Columns
Strength of Flat Plates
Strength of Cylinders
Riveting and Riveted Joints
Wire and Sheet-Metal Gages
Wire Rope
Spring Design
Strength of Shafting
Friction
Bearings
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Keys and Keyways
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Friction Brakes
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Bevel, Spiral Bevel and Hypoid Gearing
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Spiral or Helical Gearing
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V-Belt Drives
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Rope Transmissions
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Crane Chain and Hooks
Standard Bolts and Nuts
Standard Screws
Standard Wire Nails and Spikes
Cutting Speeds and Feeds
Tool Grinding
Forming Tools
Miscellaneous Automatic Screw Machine Tools
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Tapping
Change Gear Ratios
Oils and Compounds for Machining Operations
Tolerances
Tolerances for Different Classes of Fits
Screw Thread Tolerances and Allowances
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Motor Characteristics
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Is there an American Standard for (1) Acme threads? (2) 29-degree stub threads? (3) 60-degree stub threads?

Why were splines of involute form adopted as the American Standard for splined shafts and fittings?

In checking the sizes of involute splined shafts, how is the effective diameter measured?

What is the difference between a commercial ground thread tap and a precision ground thread tap?

Can you explain the meaning of the following American Standard marks or symbols for identifying threads on taps? NC; NF; N; NS; NH; NPT; NPS; NPSG; V.

What standard screw thread tolerance formula includes diameter, length of engagement, and pitch?

How many sizes of dial indicators are included in the present commercial standard?

What general classes of steels are adapted to flame-hardening?

What bearing metals would you use (a) for high resistance to fatigue? (b) for resistance to corrosion? (c) for non-scoring properties?

What range of drill diameters is covered by the American Standard for Straight Shank Twist Drills and how are the sizes designated?

If only parts or sections of a low-carbon steel part are to be hardened, is it practicable to use an activated liquid salt bath?

Under average conditions, what is the maximum ratio for silent chain drives?

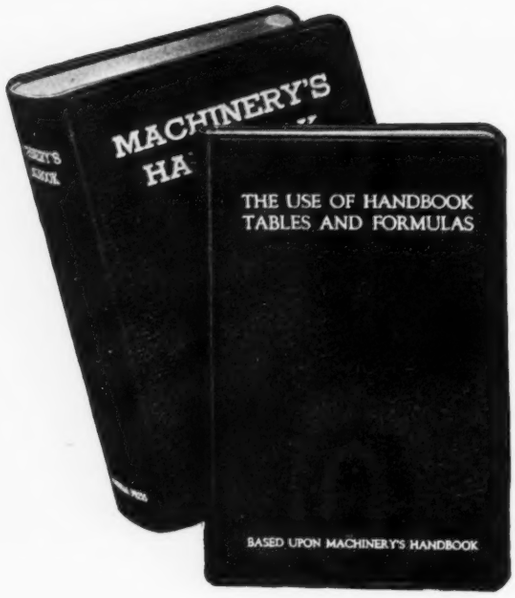
When are magnesium-base die-casting alloys used?

What temperatures usually are employed for carburizing steels, and is water or oil generally used as a cooling medium?

What non-ferrous alloy (a) offers high resistance to salt water and is readily formed and welded? (b) combines excellent resistance to salt water with good physical properties?

Is the power-transmitting capacity of a chain drive affected decidedly by the number of teeth on the smaller sprocket?

How does the heat conductivity (a) of concrete compare with bricks? (b) of glass wool compare with rock wool? (c) of plaster compare with wood?



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Formulas and Their Transposition

Logarithms and Their Practical Application

Dimensions, Areas and Volumes of Geometrical Figures

Geometrical Propositions and Constructions

Functions of Angles and Use of Tables

Solution of Right Angle Triangles

Solution of Oblique Triangles

Logarithms of Trigonometrical Functions

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ROLLWAYS carry ONLY ONE* load!

*Only One Load... THRUST!

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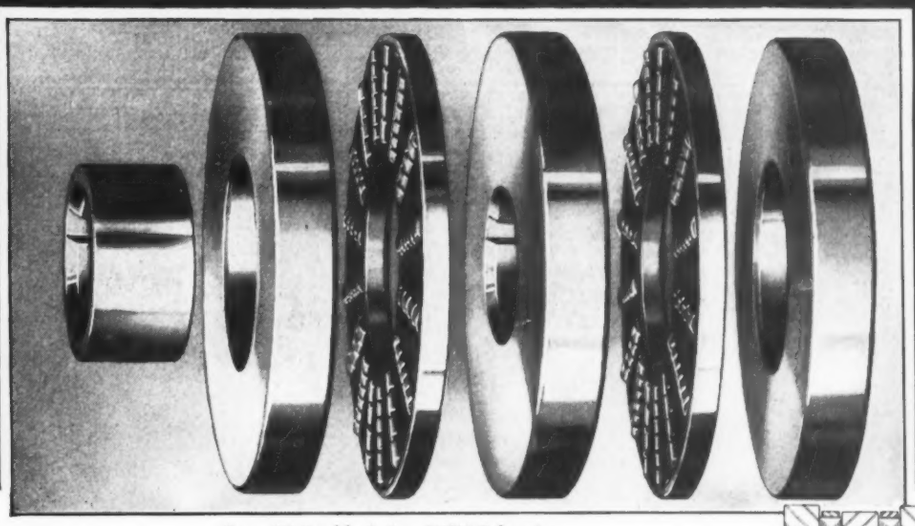
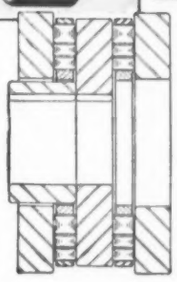


Type DT Double-Acting THRUST bearing



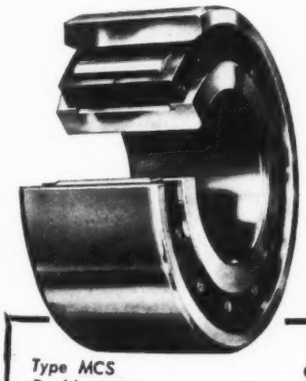
Their right-angled loading helps to Solve the maintenance problems of the 3-SHIFT, 168-HOUR WEEK!

IT'S a common error to overlook the destructiveness and magnitude of *thrust* loads—particularly when thrust is not the main component of the load. But whether uniform or variable . . . whether the result of shock, vibration or reversal of torque . . . thrust can seriously affect the life and service of a bearing and of a machine.

That's why Rollway carries every thrust load on a *separate* bearing assembly of solid cylindrical rollers. Load per roller is lower. You get greater roller cross-section per unit of load . . . and greater ability to absorb shock, vibration and wear.

More—you get rid of all oblique and compound stresses with their bothersome resultants. And you get in *thrust* bearings the factors of safety, life expectancy, and low starting torque that you expect in radial bearings.

For longer wear, less service attention and fewer shut-downs, change over now to Rollways, *the roller bearing with right-angled loading.*



Type MCS Double Width RADIAL bearing

STANDARD SIZES FOR MOST APPLICATIONS

Rollway's large number of types and series permit designing to standard metric sizes that are not only correct mechanically and practical from a cost viewpoint, but that are easier to obtain and replace, particularly in times of emergency like these. Send us your designs for free bearing analysis and "engineered to the job" recommendations.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, N. Y.

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

Detroit Broaches Are VITAL Tools in War Production

In the production of thousands of armament parts, no other metal cutting method can provide the same speed and accuracy secured by broaching. In some cases, broaches designed and manufactured by the Detroit Broach Company are performing cutting operations, now considered of vital importance, which cannot be duplicated by any other method or combination of methods.

The possibilities and advantages of broaching parts for War Production, have by no means been exhausted. In your production there are many operations on which broaching may be employed. A discussion of specific applications with a Detroit Broach engineer may provide you with a new view to increasing production . . . lowering operating costs . . . and contributing to your part.

TRIPLED CAPACITY ASSURES FASTER DELIVERY

Since the first of the year the capacity of the Detroit Broach Company has been tripled. The plant has been expanded . . . new machines have been installed and are now in operation twenty-four hours a day seven days a week. We can produce more broaches for you . . . NOW.

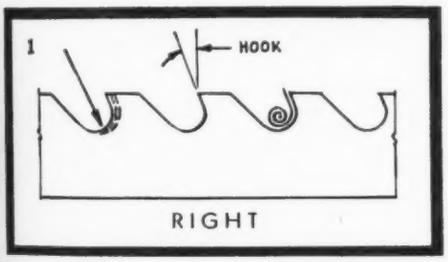
Proper Care in Resharpening Will *Prolong the Life* of Your Broaches

The products of the Detroit Broach Company are designed and manufactured to give you maximum service on the jobs for which they are intended. The *extra* life which can be expected from them is entirely dependent on the care with which they are handled in your plant.

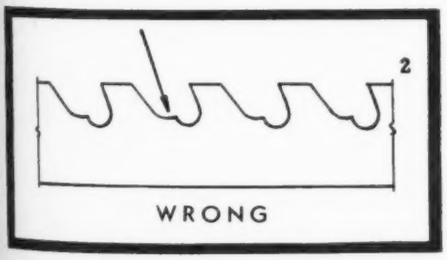
The resharpening of broaches is extremely important in prolonging the life of the tool, and to cover briefly the principal sharpening operations, we submit the following for your information:

TOOTH FORMING

The form of the tooth is an all important factor in the proper working of the tool. For example it will be noticed in Sketch No. 1 that the proper method of resharpening is shown by dotted lines which indicate a succession of sharpenings. In each instance you will note that, as near as possible, the original form of the tooth is maintained.

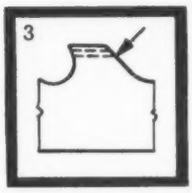


In Sketch No. 2 you will notice that, in resharpening, the operator has not blended the form. With this condition, in a great many instances the chip will stick and cause the tooth to load. If not cleaned out this may cause breakage at this point in the broach.



Also, the proper hook angle should be maintained as different materials require different hook angles. This information should be available on the tool drawing.

On surface broaches, where the broach has means of adjustment by the use of shims, wedges, etc., the sharpening can be accomplished by backing-off the top of the teeth as shown in Sketch No. 3. Because this method reduces the depth of the tooth form—or the chip space—it is occasionally necessary to supplement the form sharpening, as previously described and illustrated in Sketch No. 1, after the tooth form has been altered by repeated backing-off. This combined sharpening process will increase the life of the broach tremendously.

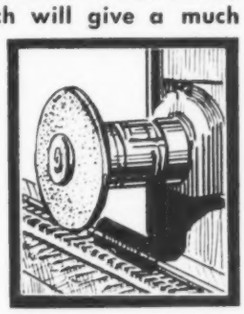


TOOTH FINISHING

Another important factor is the finish obtained on the face of the cutting tooth. When the face is rough, it is only natural that the cutting edge itself will be rough. If looked at through a magnifying glass this rough cutting edge looks much like the teeth of a saw. This, of course, means that in actual operation these teeth will break down much faster than if the face of the tooth were perfectly smooth, thus making the cutting edge equally smooth.

THE WHEEL TO BE USED

In sharpening broaches it is well to use a soft wheel which will give a much smoother face. This is something that cannot be definitely set as the type of the machine will govern somewhat the size of the wheel, and also the grain.

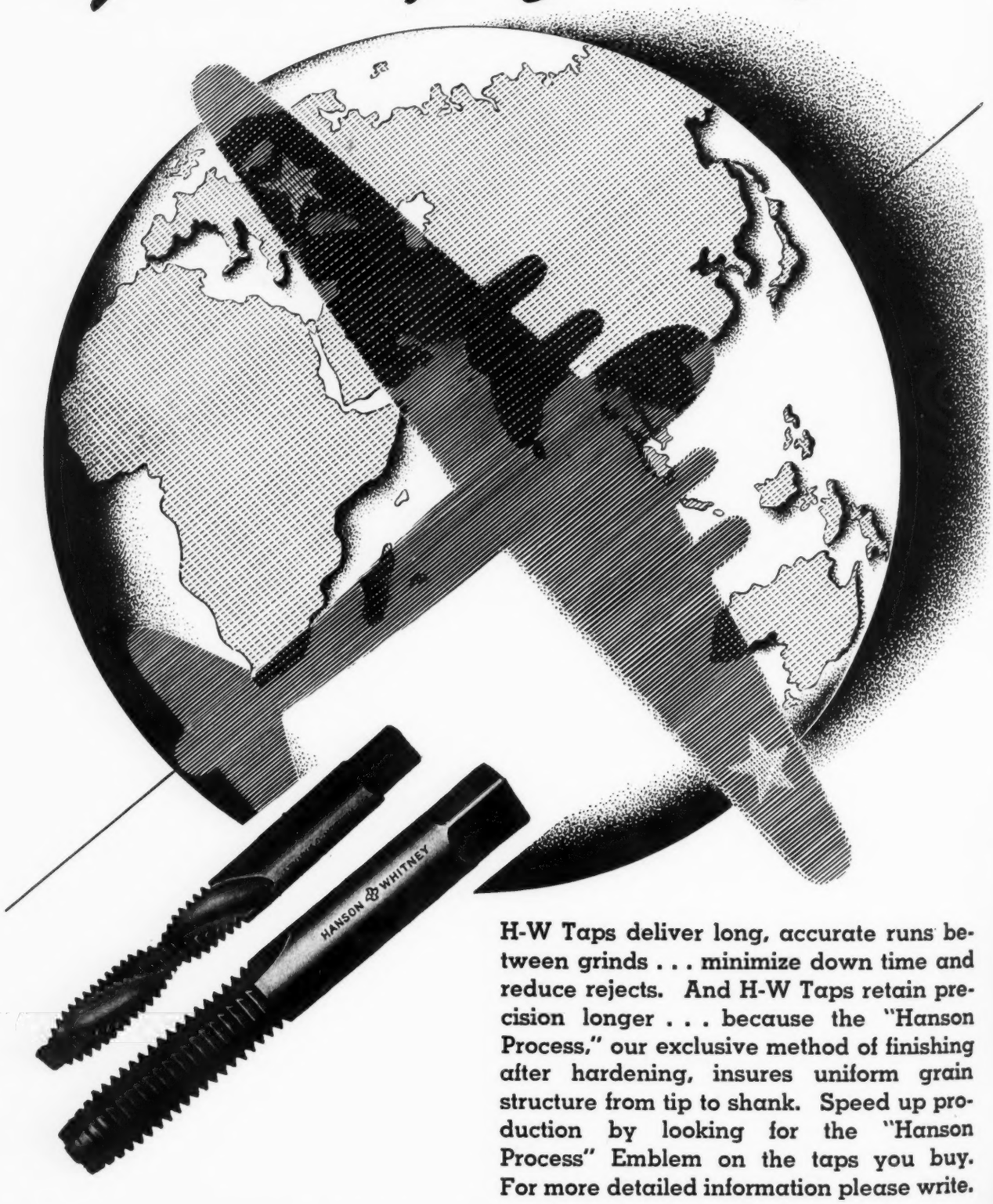


Copies of this page, printed on heavy paper, and suitable for hanging in the shop are available without obligation upon request.

DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE • DETROIT, MICHIGAN

Big Enough for the Job



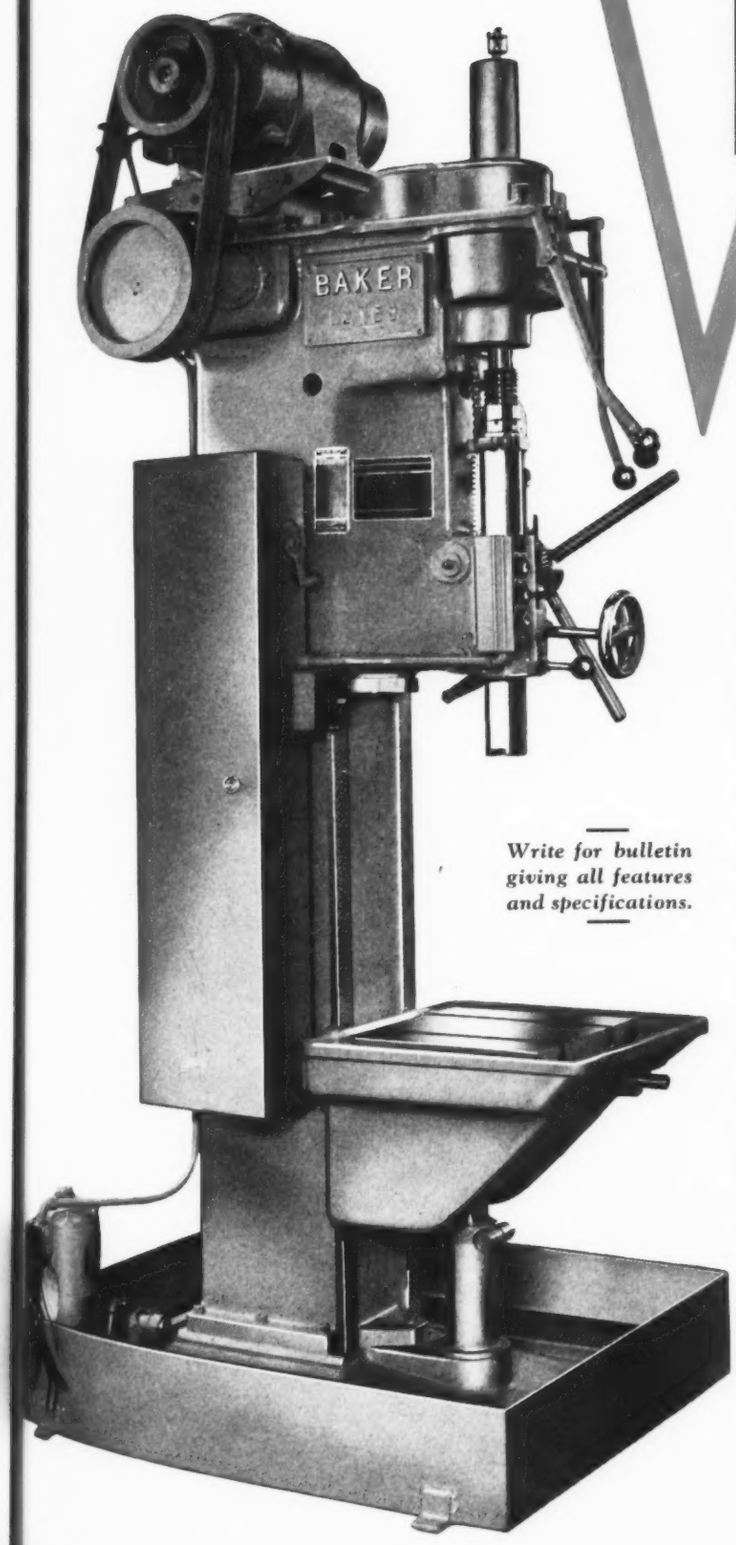
H-W Taps deliver long, accurate runs between grinds . . . minimize down time and reduce rejects. And H-W Taps retain precision longer . . . because the "Hanson Process," our exclusive method of finishing after hardening, insures uniform grain structure from tip to shank. Speed up production by looking for the "Hanson Process" Emblem on the taps you buy. For more detailed information please write.

The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

MUNITIONS PLANTS
need this Machine for the

VICTORY *Program*



Write for bulletin giving all features and specifications.

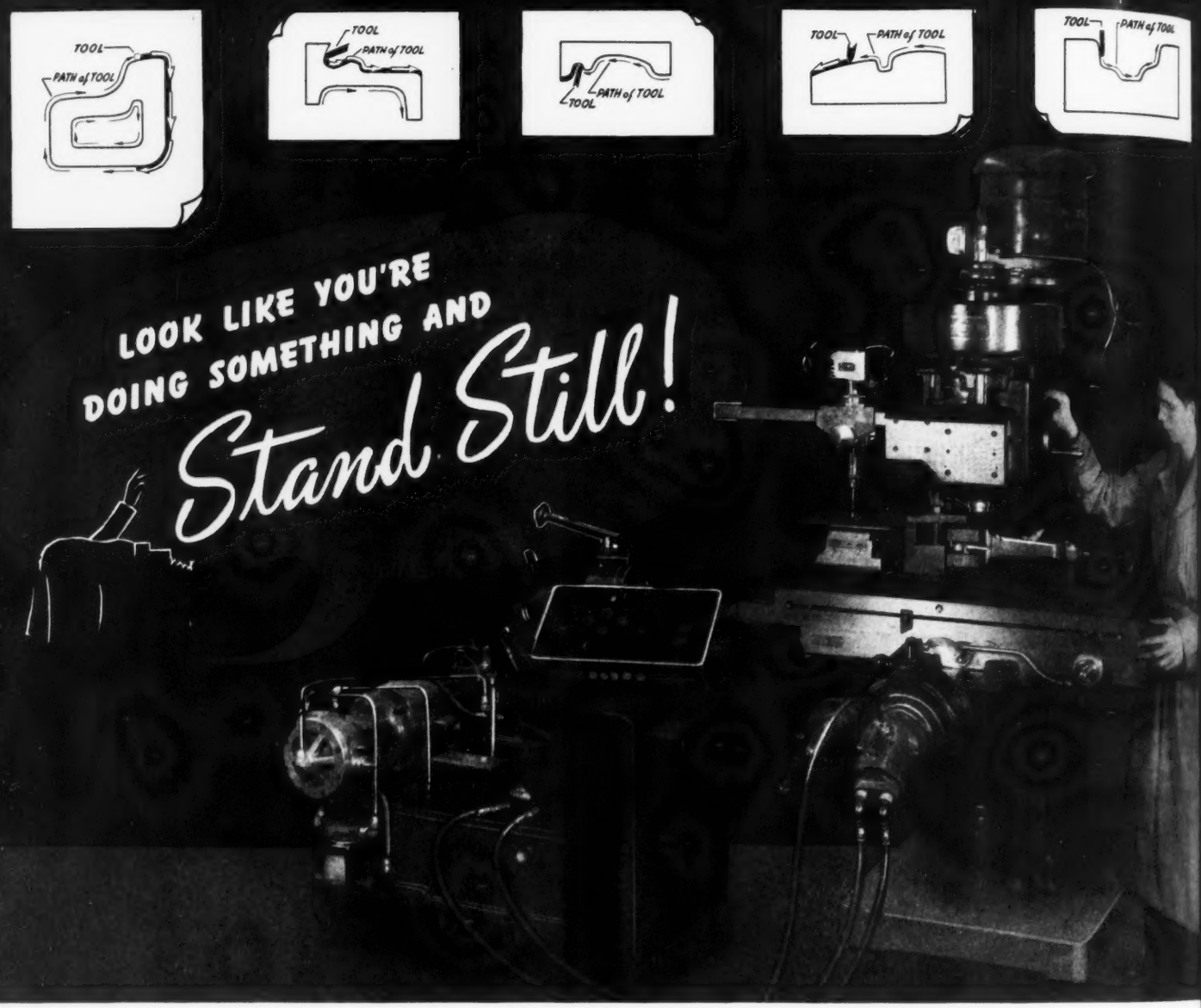
This newly designed Model 150 Heavy Duty Drill features the *extra flexibility* so necessary to high speed war production. This is a single spindle machine, but it has the capacity to drive a 1½" diameter high speed twist drill to the limit of its efficiency. It is well adapted to boring, counterboring, facing, forming and tapping operations. Its spindle is of forged high carbon steel carrying a No. 4 Morse Taper, and is designed for driving heavy duty tools. A quick choice of 12 speed changes can be made by means of convenient levers and sliding hardened gears. Feeds range from .005" per rev. to .143" per rev. with five different feeds; by transposing gears, ten feed changes are available. Maximum distance end of spindle to plain table 34", to finished base surface 48½". Standard speed range 48 to 1120 rpm. Motor sizes 5 hp. or 7½ hp. The wide selection of feeds and speeds, the twopiece frame design, the distance of 13½" available from center of spindle to frame (standard 11") —these are but a few Baker features which make this No. 150 the ideal heavy duty Drill for speedy wartime production.

BAKER BROTHERS, Inc.
TOLEDO, OHIO

BAKER

Model 150 UNIVERSAL QUICK CHANGE TYPE HEAVY DUTY DRILL

Geared Feed



• • the photographer said. And while the operator leaned gainst the machine and looked awkward, this contour milling peration continued at full speed!

When a DUPLIMATIC is attached to any machine tool—such as his vertical mill—all an operator does is load the work and ush a button! The rest of the operation is automatic.

WHAT'S A DUPLIMATIC?

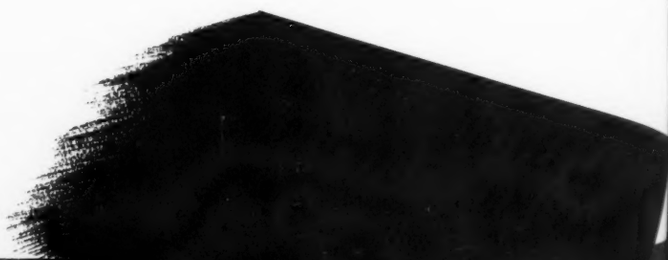
he Dual DUPLIMATIC is a separate, self-contained machine ol control mechanism. It is used with your present tool room ols. It is moved alongside any engine or turret lathe, boring ill, shaper or vertical mill and connected with any two feed rews in one day's time. The following day the operator of at machine—or another operator even less skilled—should **crease production by 7 times . . .** (an average.)

the vertical mill illustrated, it turns the two feed screws tomatically *and* simultaneously, thereby generating a smooth ntour. (It is the only control that can turn two or three rews simultaneously.)

High Speeds at Tool Room Accuracies

Because DUPLIMATICS can quickly convert tool room mach tools into high production speed automatic operation with any sacrifice in accuracies, DUPLIMATICS have been accep as standard in the biggest war production plants. Cont machining which DUPLIMATICS control include: **TORPEDO BOMBS—GUN PARTS—AIRPLANE ENGINE PARTS—TANK TURR —ANTI-AIRCRAFT GUN PARTS—AIRPLANE LANDING WHEELS** on all of these, scrapped parts have been reduced, hand-fin ing cut and accuracies easily held.

Send now for information. If possible, send a sketch or p of the work.



This is DUPLIMATIC and DUPLIMATIC is MASS PRODUCTION

This is your Industrial Supply Distributor's pledge to help you keep your contracts moving with never the loss of a minute's production if it can be avoided. It means he will put forth every resource to keep you furnished with the vital supplies and equipment you must have to keep up your share of the War Effort.

It will make your work easier, simpler, less costly, to buy through your own nearby Mill Supply House, because:—

1—Mill Supply Houses do their buying from literally hundreds of Manufacturers and are trained to keep hunting for what you need until they find it.

2—Their facilities are organized to handle all the complicated details of contacting, buying and expediting deliveries from scores of these suppliers, *every day.*

3—They buy outright large stocks of supplies they know you will need—sometimes 25,000 or more separate items—then stock them for quick delivery to you.

4—They know Priorities and can help you obtain essential materials in cases where you do not have blanket authorization.

5—If they cannot complete your order in one delivery they usually can rush out an emergency supply saying "here's enough to keep you going—more soon."

Take your own Mill Supply Distributors into your buying confidence—let them serve you as a vital source of supply not only now, but permanently.

Our own great faith in them is based upon the many years' experience in which they have represented us as Distributors of Cle-Forge High-Speed Drills and Peerless High-Speed Reamers nationwide.

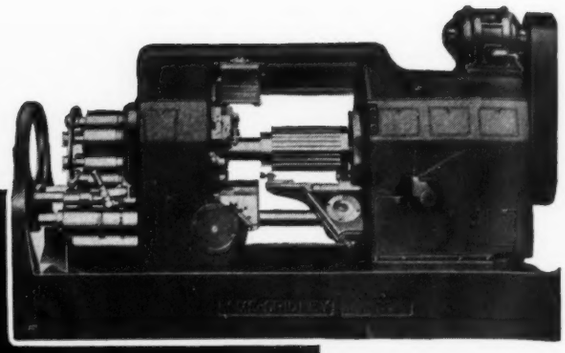
This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

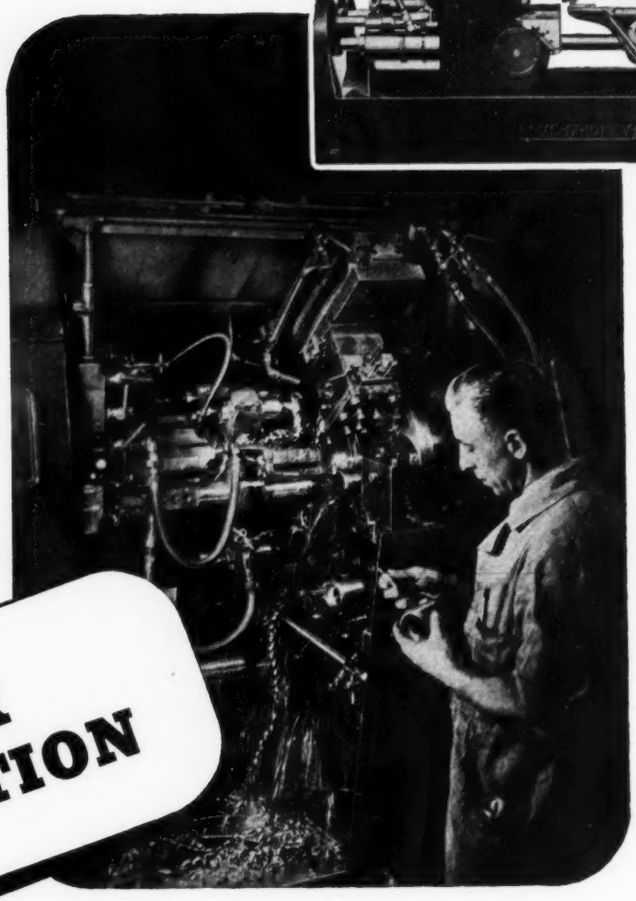
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST. E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU



●2¼" Acme-Gridley Bar Automatic built by National Acme Co.



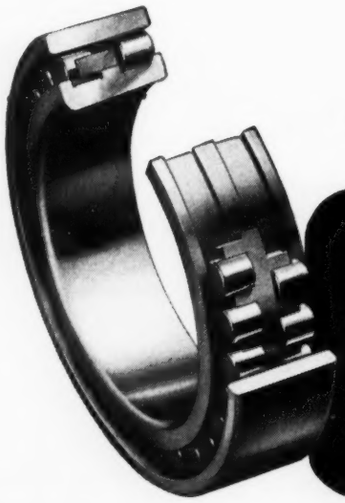
FOR PEAK PRODUCTION

IN spite of war production shifting into high gear, manufacturers are *maintaining extreme accuracy* on their lathes with the SKF Spindle Mounting. SKF's assure:

1. *Continuous peak production from heavy cuts and high speeds.*
2. *Freedom from chatter.*
3. *Maintained accuracy.*
4. *Long life.*

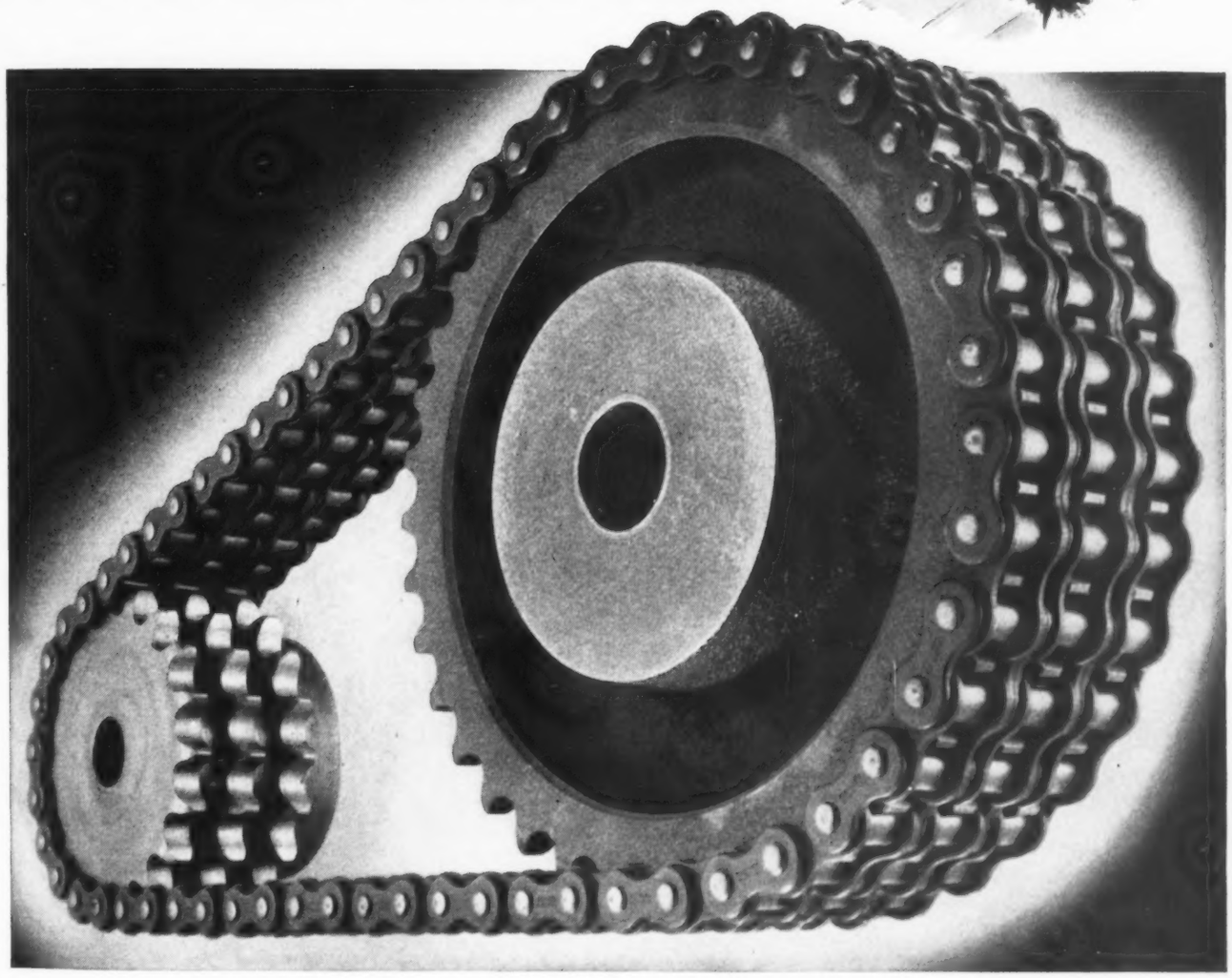
5093

SKF INDUSTRIES, INC., PHILA., PENNA.



SKF
BALL AND ROLLER
BEARINGS

Fight off POWER-DIVES on Your Production Line... with WHITNEY POWER DRIVES



WHITNEY Chains are designed to maintain positive, non-slip operation which transmits full power straight through to the job . . . at constant speeds that protect product-uniformity. And the extra life of Whitney alloy-armored steels is an equally important plus-value now that replacement chains are not always readily available. So on all *your* war-production work, make Whitney Chains your Drive to Victory.

How to Prolong the Life of your WHITNEY CHAIN DRIVES

Keep sprockets properly aligned . . . chains properly lubricated . . . and you will get maximum drive life. Also, be sure to inspect your drives regularly. Keep 'em rolling.

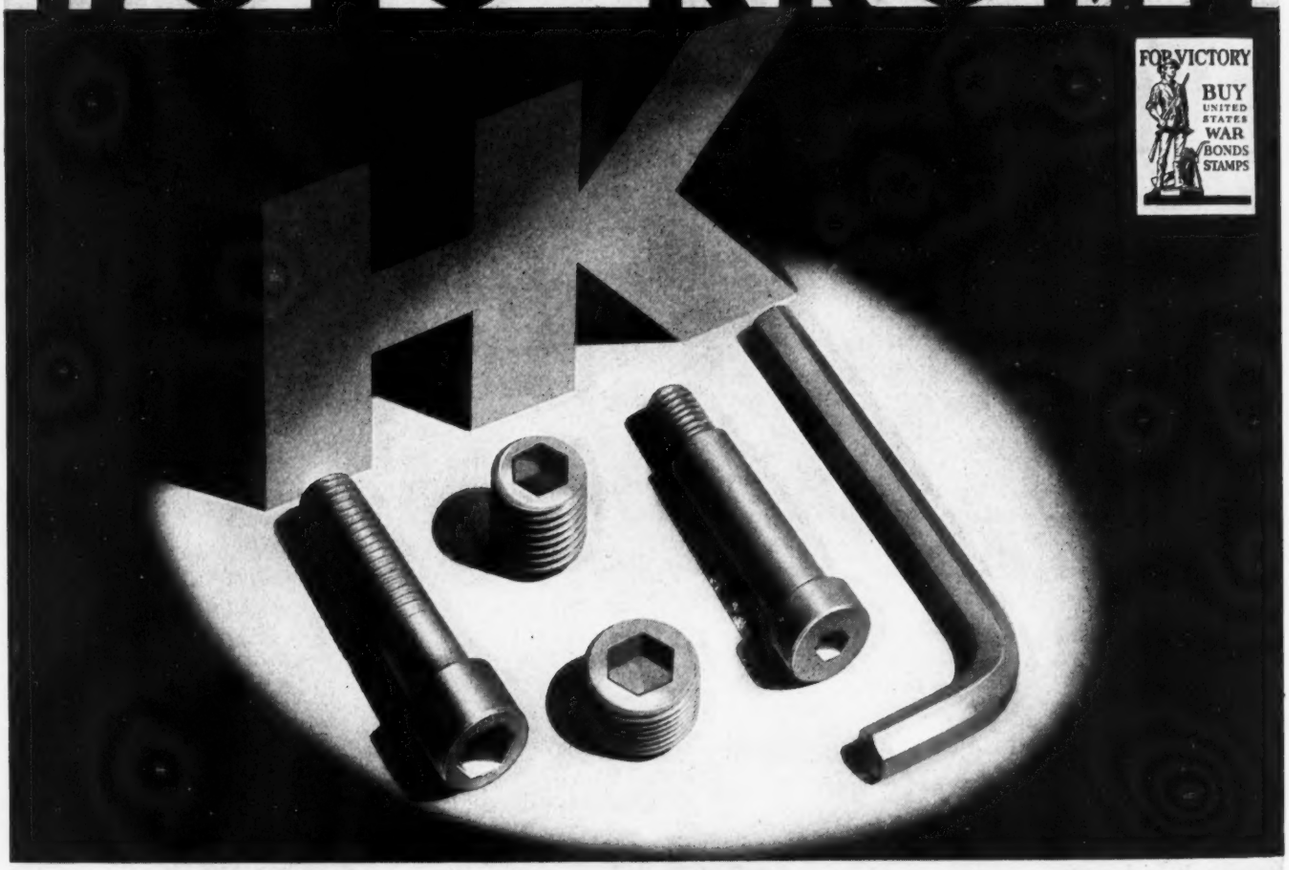
DRIVE FOR VICTORY WITH WHITNEY CHAINS

The Whitney Chain & Manufacturing Co., Hartford, Connecticut

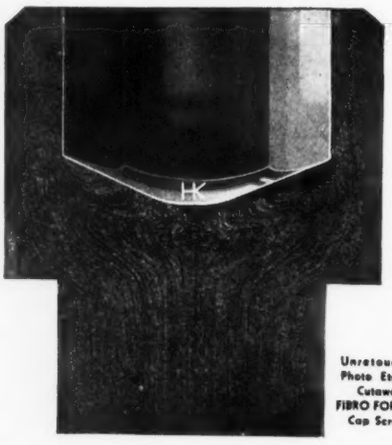
fibro forged TRADE MARK SOCKET SCREWS

MADE EXCLUSIVELY BY

HOLO-KROME



COMPLETELY COLD FORGED FROM SOLID STOCK



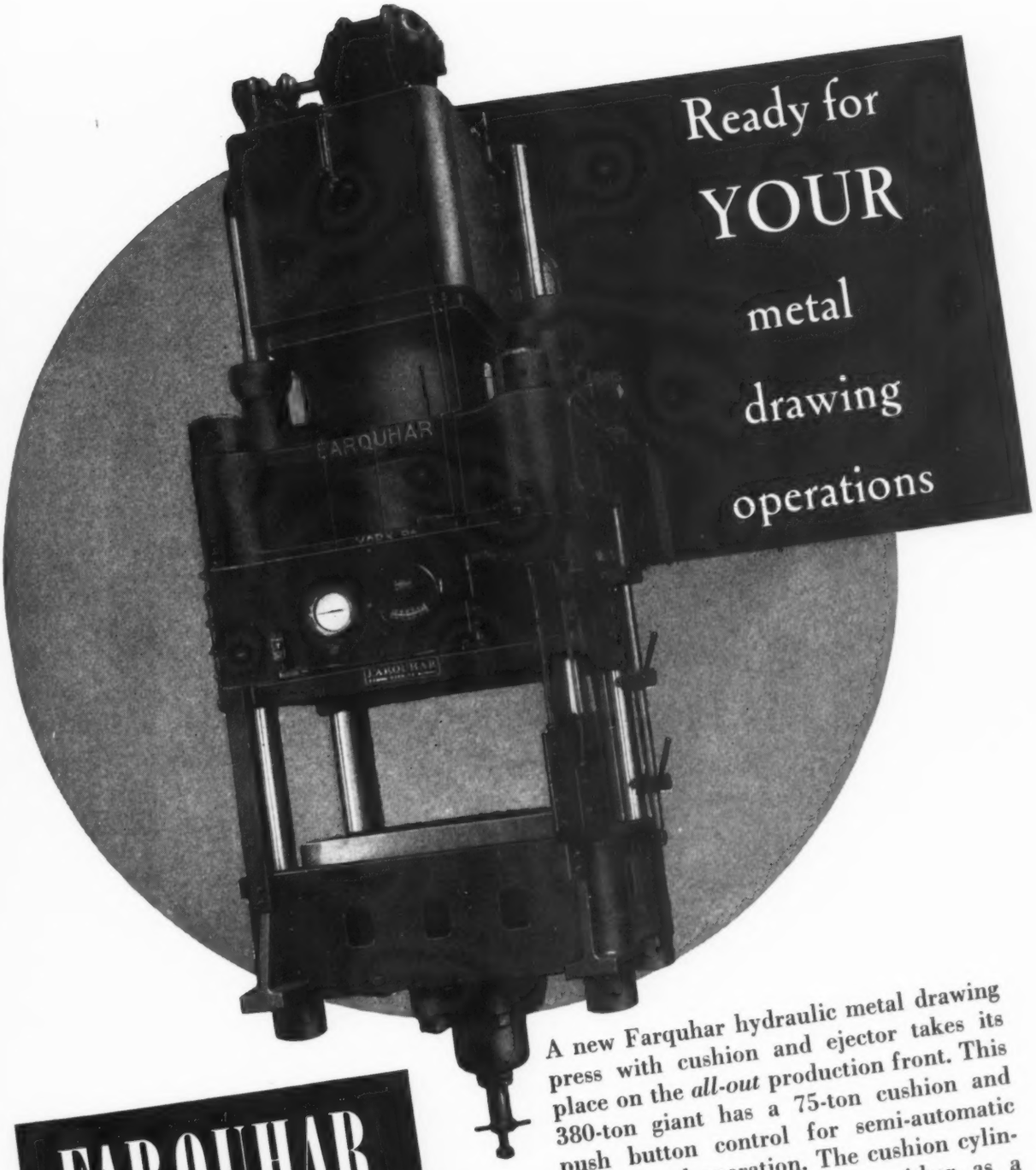
Unretouched Photo Etched Cutaway FIBRO FORGED Cap Screw.

THE RESULTS OF A SUPERIOR METHOD PATENTED BY HOLO-KROME

GUARANTEED Unfailing PERFORMANCE

HOLO-KROME SOCKET SCREW STANDARDS AVAILABLE

THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.



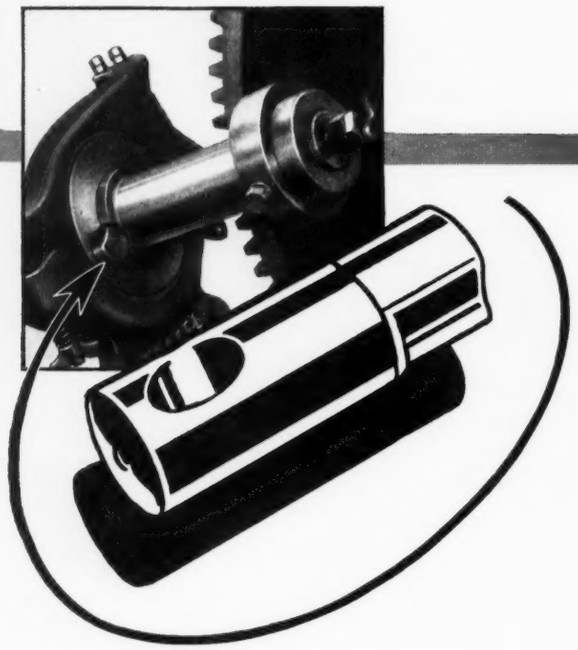
FARQUHAR
Self Contained
HYDRAULIC
PRESSES

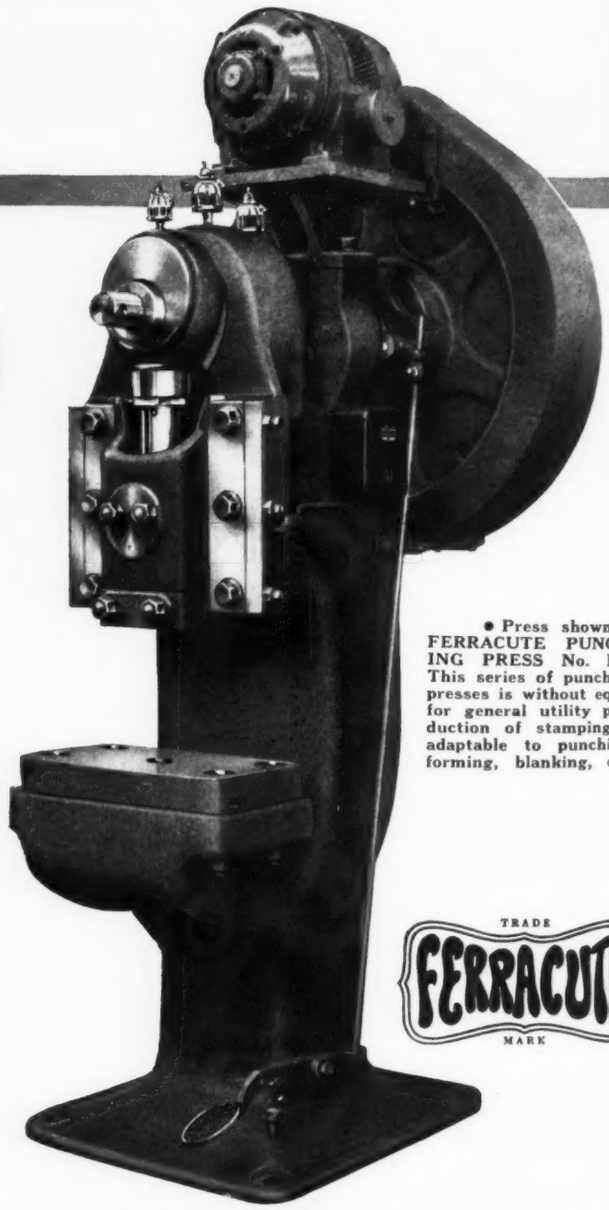
A new Farquhar hydraulic metal drawing press with cushion and ejector takes its place on the *all-out* production front. This 380-ton giant has a 75-ton cushion and push button control for semi-automatic and manual operation. The cushion cylinder is arranged to operate either as a cushion or an ejector . . . with separate, independent pressure adjustment of the cushion. Daylight, 24 inches; stroke, 18 inches. Bed measures 42¼ inches clear, left to right, 36 inches front to back. For details, write Hydraulic Press Division of A. B. Farquhar Co., Limited, 155 Duke St., York, Pennsylvania.

Farquhar builds high speed hydraulic presses for all types of metal working . . . from 3 to 7,200 tons capacity.

FERRACUTE'S PLUS VALUES are now paying off in PRODUCTION

Once they may have seemed like salesman's talking points—those "plus values" of FERRACUTE presses—but now that American war industry approaches the pay-off hour, they are paying off in PRODUCTION. FERRACUTE's *extra* engineering details, *extra* standards of strength of materials, *extra* safety factors, *extra* guards against breakdowns, *extra* ease of adaptability—all are triply important now that something *extra* is essential for continuous, uninterrupted war production that is punishing to men and machines. And sometimes a little *extra* knowledge will help improve the performance of even FERRACUTE presses.





• Press shown is FERRACUTE PUNCHING PRESS No. P4. This series of punching presses is without equal for general utility production of stamping—adaptable to punching, forming, blanking, etc.

WATCH DOG OF PRODUCTION

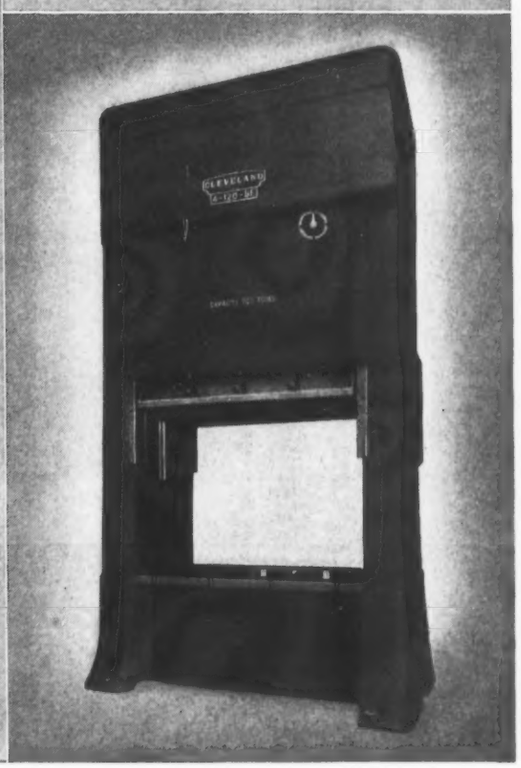
The Driving Dog on the FERRACUTE Automatic Pin Clutch is a watch dog of production, designed to prevent costly breakdowns and long shutdowns for repairs. Made of Alloy Steel, carefully heat-treated, the Dog or Clutch Slide will give you years of service under normal conditions. It is designed, however, to break when the press is dangerously overloaded—thus preventing more serious damage to press, dies, or to operator. The slide is easily replaced since it is round and can, in an emergency, be made in any machine shop.

The FERRACUTE Automatic Pin Clutch is typical of the "plus values" engineered into FERRACUTE presses. It is safe, sure, quickly adaptable, low in maintenance delays.

TRADE FERRACUTE MARK

FERRACUTE MACHINE COMPANY
BRIDGETON, N. J., U.S.A.

The Long Range Point of View



In common with all other Industrial concerns, we at The Cleveland Punch and Shear Works Company are keeping the wheels turning day and night to fill our orders and meet promised delivery dates.

But we, too, are thinking about tomorrow, and, even in the stress of the present emergency, are determined to maintain that quality inherent in all Cleveland Presses, to the end that machines built to meet present day requirements can quickly be converted to peace time needs when the time comes.

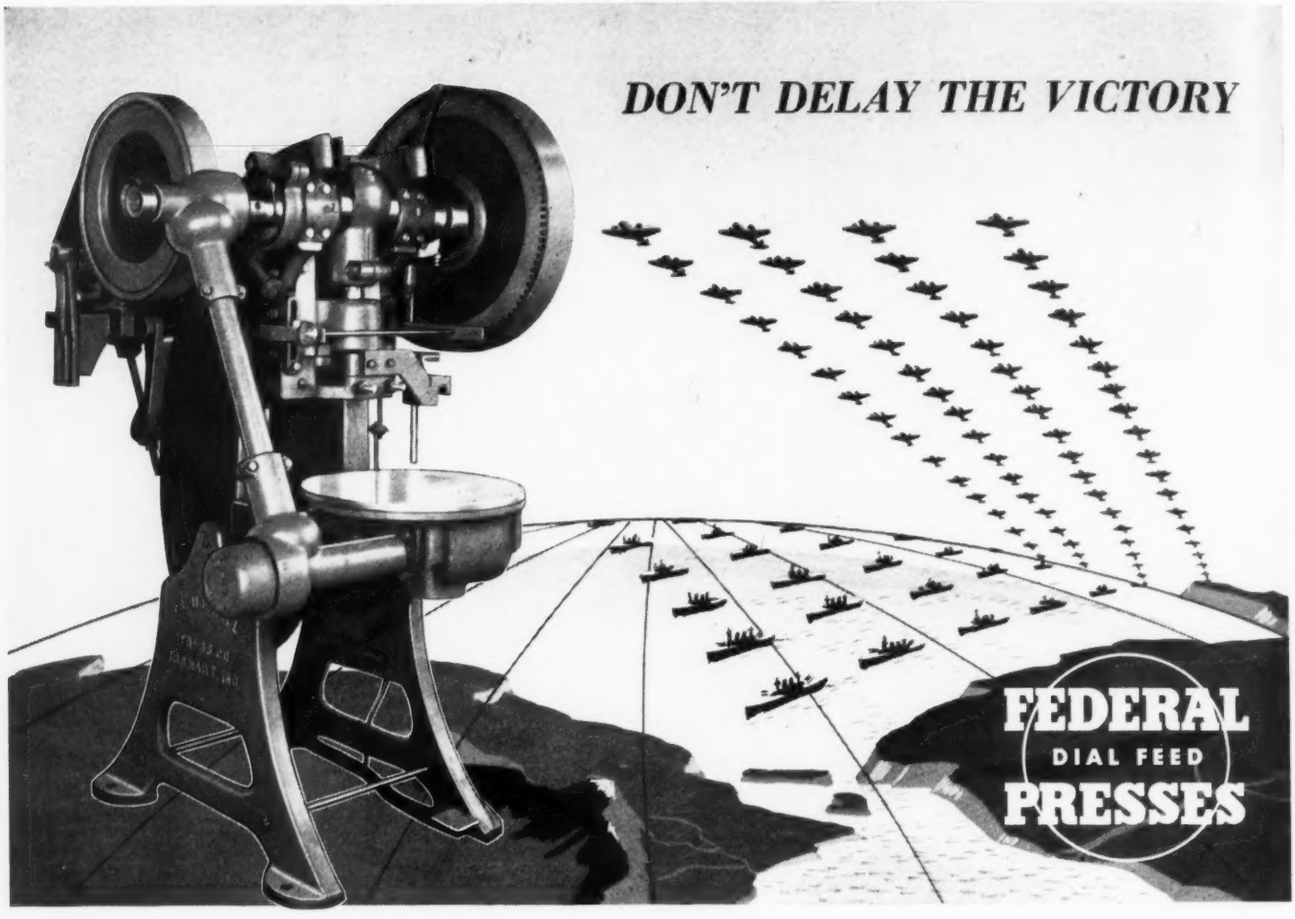
This is the long range point of view which has for the past sixty years, been synonymous with the name CLEVELAND.

The large illustration shows a Modern Cleveland 4-Point Press having a capacity of 750 tons, stroke 50", adjustment 6", Bed area 80"x144", shut height 60" and operates at 14 strokes per minute.

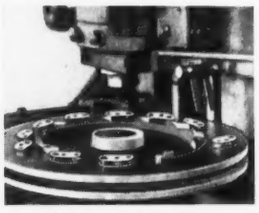
The smaller illustration shows a Modern Cleveland 4-Point Press having a capacity of 750 tons, stroke 30", adjustment 6", Bed area 80"x120", shut height 60" and operates at 14 strokes per minute.

Modern Presses THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH



Speed PRESS ROOM OPERATIONS WITH FEDERAL DIAL FEEDS



Don't delay victory by using old, incompetent press equipment in your plant! Now you can *speed up* many primary and secondary operations from *three to six times*—and even more—by using Federal precision-built presses with multiple dial feeds! Check all these important features:

Positive indexing and locking mechanism smooths out action of the exclusive Federal dial—permitting unusually rapid production with exceptional accuracy and safety to the operator. Easily indexed to any part of the crankshaft revolution from 90° to 180°, giving long or short dwell of the dial. Cannot skip or coast by stations. All moving parts are enclosed. Automatic loading and ejector mechanisms can also be furnished if desired. And dial feeds are available in eight sizes of Federal Presses.

Speed up victory! Write for latest illustrated literature on the complete line of Federal Presses. There is no cost or obligation.

THE FEDERAL PRESS CO.

708 Division Street, Elkhart, Indiana.

A FEW OF THE COMPANIES WHICH ARE SPEEDING PRODUCTION WITH FEDERAL DIAL FEED PRESSES

General Electric Co. Wheeling Steel Co. B. F. Goodrich Co.
Bendix Products Co. General Tire & Rubber Co.
Ohio Rubber Co. C. G. Conn, Ltd. P. R. Mallory Co.
Fulton Sylphon Co. Barnes Gibson Raymond Co.
Firestone Tire and Rubber Co.

MANY FEDERAL MODELS

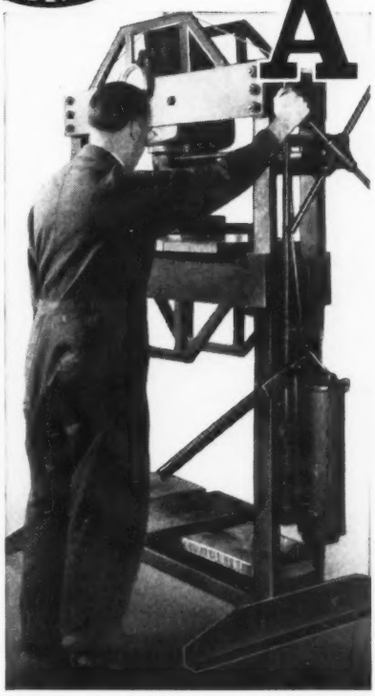
Federal Open-Back, Inclinable Presses are available in nine sizes, with capacities ranging from six to 80 tons—either flywheel or geared type. They represent the culmination of Federal's 40 years' intensive experience in press building.

SINCE 1916 KRW A MARK OF DEPENDABILITY

HYDRAULIC ARBOR PRESSES

—are as FAST as ...

A

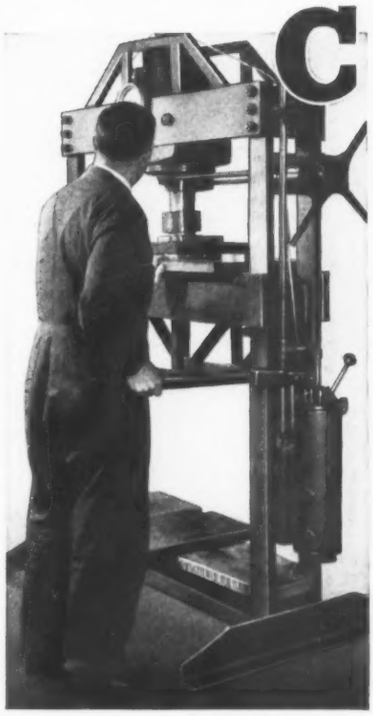


SPIN THE HANDWHEEL and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.

B

FLIP THE BALL ARM to close the valve instead of slowly turning a handwheel type control.

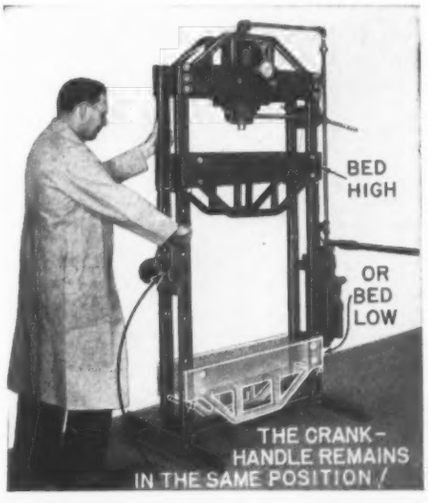
C



START PUMPING and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during oper. No. 1.

● With Time so terribly short, every second saved in any operation adds greatly to our War effort. The built-in Speed of KRW Presses is as Fast, and simple, as A B C. KRW Hydraulic Arbor Presses are fast bringing the ram to the work... fast in developing hydraulic pressure... fast in raising the ram to remove the work. Another time and labor saving KRW feature is the stationary bed adjustment control... no matter where you move the bed, the ratchet control crank remains at convenient operating height. Write for bulletin describing 25, 50 and 75 ton presses... priced from $198.00*.

**Prices F. O. B. Arcade, N. Y. Slightly higher west of Rockies*



K. R. WILSON

MAIN OFFICE: LOCK ST., BUFFALO, N. Y., U. S. A.
EXPORT OFFICE: 90 WEST ST., NEW YORK, N.Y., U. S. A.
CANADIAN: A. R. Williams Machinery Co. Ltd., Toronto-Montreal

MAIL THIS COUPON

K. R. WILSON, 36 Lock St., Buffalo, N. Y.
Please send Hydraulic Arbor Press Bulletin No. 36.

Name .....
Address .....
City ..... State .....

MAKE SMALL STAMPINGS WITH ACCURACY and SPEED

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.

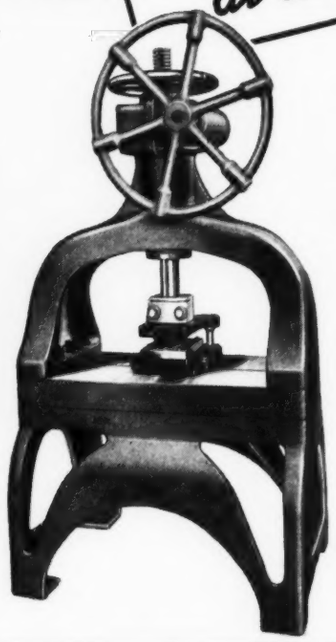
Waltham Sub Presses speed up the production of small stamped parts . . . Waltham design assures accurate, clean-cut work. Ruggedly constructed in plunger sizes from 1 3/16" to 6" in diameter, they maintain original alignment indefinitely because plunger bearings are adjustable for wear. Supports of Overhang type, illustrated, are placed so as to allow plenty of light for locating second or third operations. Also made in Arch type, especially suitable for strip work.

Write for bulletins describing Waltham Sub Presses and Waltham Automatic Machines.

OVERHANG TYPE

WALTHAM MACHINE WORKS
Newton Street, Waltham, Mass.
Makers of Small Thread Millers, Gear Cutters and other Small Automatic Machines

MAXIMUM USEFULNESS at Low Cost!

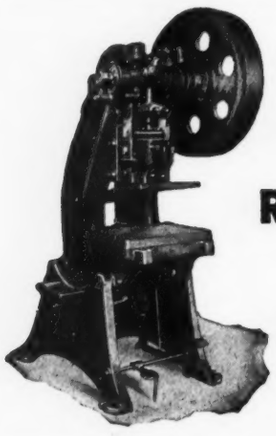


More adaptable than ordinary Screw, Arbor or Power Presses, especially on punch and die work, the Producto Utility Press can serve in dozens of ways in every shop. Fifty tons pressure can be exerted—and accurately controlled through the worm and worm gear, which is mounted on large thrust bearings. Its sensitive control makes it ideal for use as a straightening press.

Write for Bulletin outlining its construction details and its many uses in every type of shop.

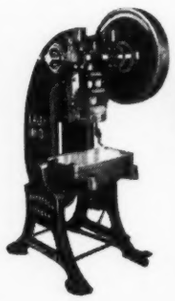
Manufacturers of Producto Die Sets and Machine Vises

THE PRODUCTO MACHINE CO.
BRIDGEPORT, CONN.



POWER PRESSES
Roll & Dial Feeds

ZEH & HAHNEMANN CO.
182 Vanderpool Street
NEWARK, N. J.



L&J Inclinable
POWER PUNCH PRESSES
Model No. 3

22 TON CAPACITY
120 STROKES PER MINUTE
8¼ or 10¼" DIE SPACE
(Bed to Slide, Stroke down, adj. up.)
2½" STANDARD STROKE
2050 LBS. WEIGHT
PRECISION BUILT
DELIVERIES REASONABLY PROMPT
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STANDARD SINCE 1911

L & J PRESS CORP. Elkhart, Ind.
1631 STERLING AVE.
SUCCESSORS TO LOSHBOUGH JORDAN TOOL & MACHINE CO.

BETTER-MADE DIE SETS

AT LOWER COST

46 DIFFERENT STYLES

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AUTOMATIC MACHINERY BAIRD BRIDGEPORT CONNECTICUT U.S.A.

MULTIPLE SPINDLE LATHES
MULTIPLE SPINDLE GRINDERS
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FOOT AND POWER PRESSES
TUMBLING EQUIPMENT

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Manufacturers of
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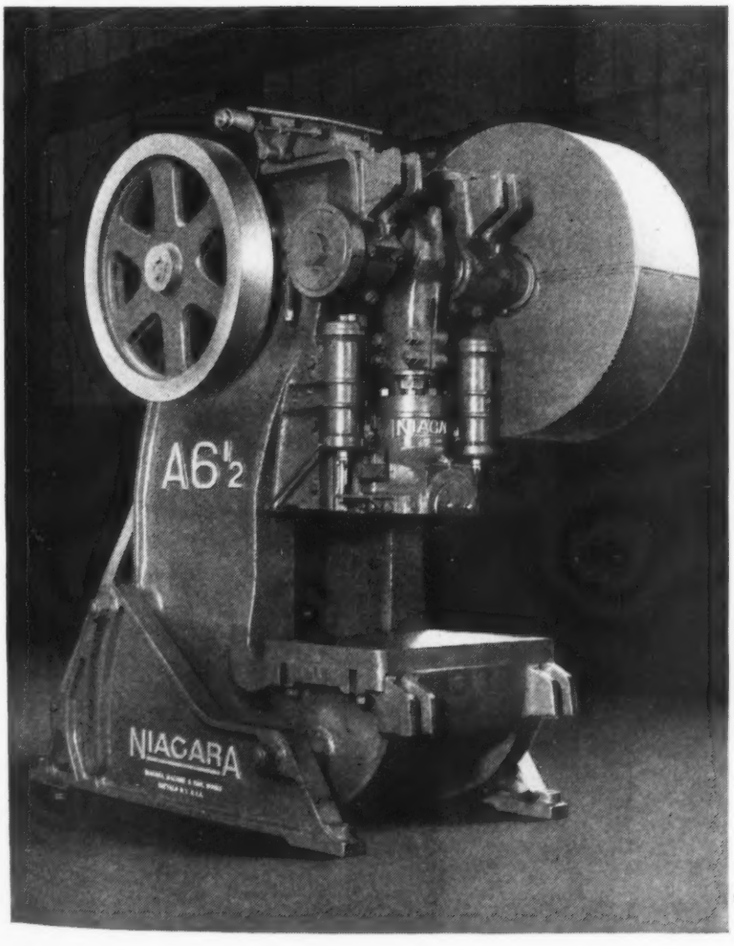


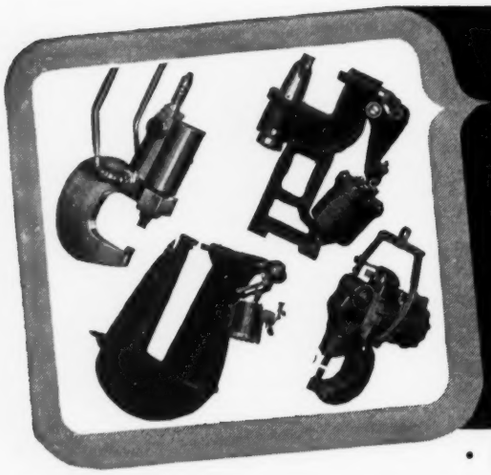
Manufacturers of America's warplanes are using Niagara machines for shearing and forming sheet metal.

Niagara presses and shears are helping production men shatter all records.

High production, convenient handling of the work, rugged construction that reduces down time are results of the talent and experience built into Niagara machines.

The complete Niagara line of presses, shears, and sheet metal working equipment provides the most productive and economical machine.

Write for bulletins. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Cleveland, Detroit, New York.



Hanna RIVETERS

Pneumatic • Hydraulic • Portable • Stationary

• The Hanna line of riveters includes over 700 styles and sizes. Capacity ranges from ⅛" diameter up to 2½" diameter rivets. Reach or throat sizes from 2" to 22'. What is your riveting problem? Write us for a solution.

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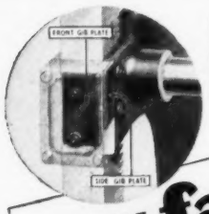
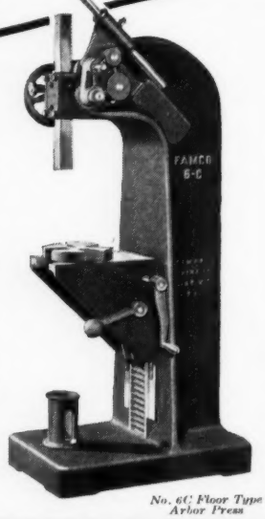
1765 ELSTON AVE. • CHICAGO, ILL.

• CYLINDERS • RIVETERS • VALVES • HOISTS •



Simple adjustment of front and side gib plates gives positive control of ram alignment — eliminates any variance.

ONLY famco OFFERS ADJUSTABLE GIBS!



No. 6C Floor Type Arbor Press

You can always be sure of perfect ram alignment with Famco's exclusive adjustable gib control. Standard on all Famco Arbor Presses, it compensates for wear . . . eliminates "shimmy." That's why Famco Presses can step up production and assembly jobs in your plant. Write today for complete facts on Bench and floor types. *40 stock sizes* . . . half ton to 15 tons pressure.

FAMCO MACHINE COMPANY
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famco FOOT AND ARBOR PRESSES

DANLY DIE SPRINGS

MEDIUM PRESSURE | HIGH PRESSURE
HIGH DEFLECTION | MEDIUM DEFLECTION

A COMPLETE LINE TO FILL EVERY DIE MAKING SPECIFICATION

DANLY PRECISION DIE SETS AND DIE MAKERS' SUPPLIES

DANLY MACHINE SPECIALTIES, INC.
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S&S

QUICK LOADING STOCK REELS

SINGLE INCLINABLE FOR COILED STRIP STOCK
DOUBLE SWIVEL FOR COILED STRIP STOCK

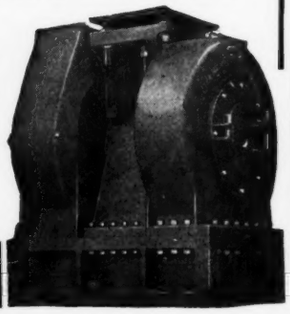
When feeding stock from coils to punch press or any other machine, the S & S Stock Reels make for speed and economy. Easy to load — no screws to loosen or tighten — dependable. Single Inclinable Reel sets in any plane. Double Swivel Reel permits loading of one coil while other is reeling out stock . . . a "reel time-saver."

S & S MACHINE WORKS, 4541 W. LAKE ST. CHICAGO, ILLINOIS

ETNA SWAGING MACHINES

Etna Swaging Machines are built in capacities of 3/8" to 4" dia. with die lengths 1" to 18". Larger sizes built to order.

Write now for booklets!



The ETNA MACHINE Co.
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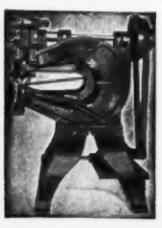

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GRAY, Originator of First Practical Metal Cutter or Nibbler

Most modern Nibbler for Template Cutting, Tool Rooms, Shipbuilding, Aircraft Parts, Aircraft Tubing, Sheet and Plate Shops.

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THE V & O Press Co, INC.
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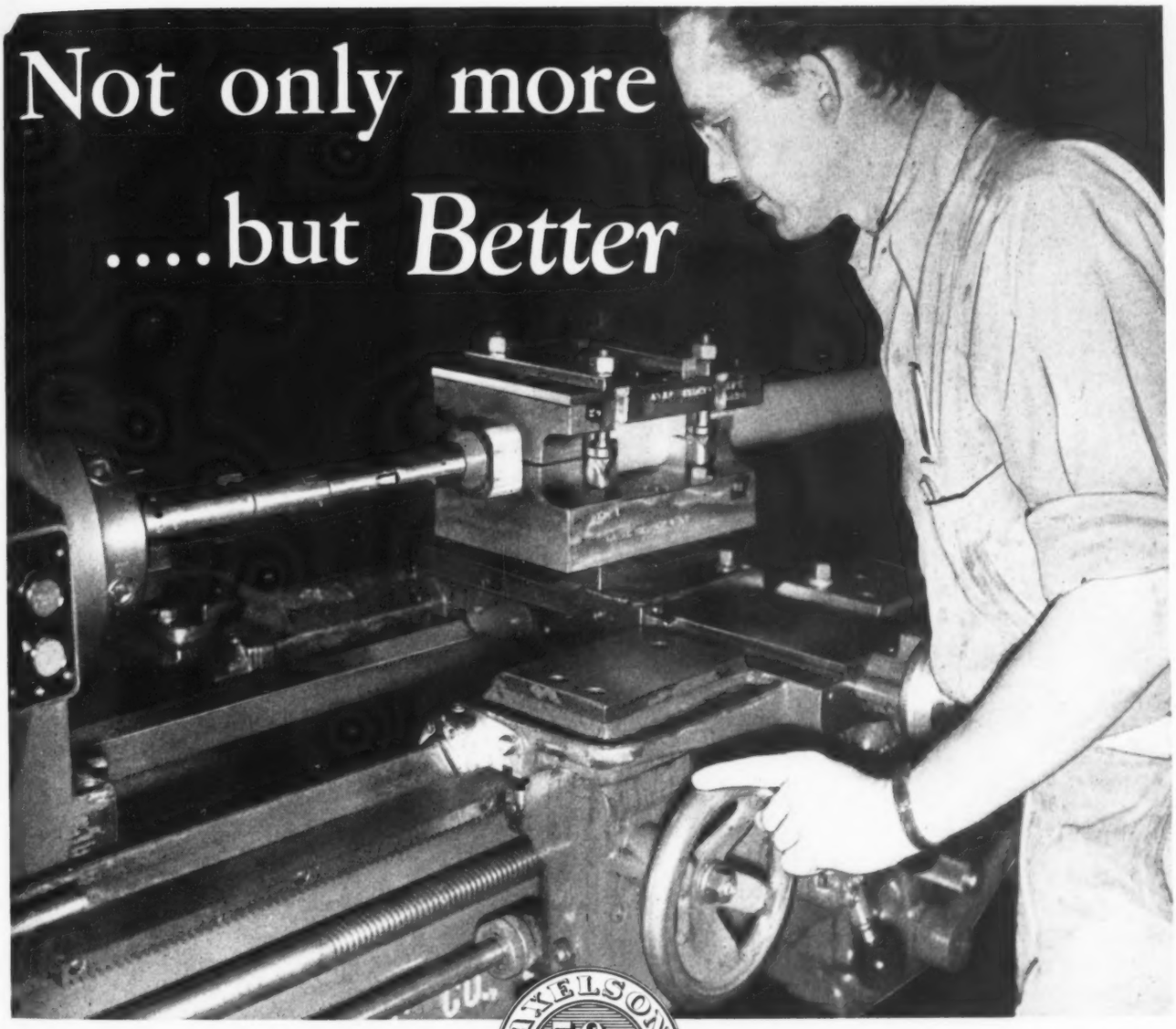
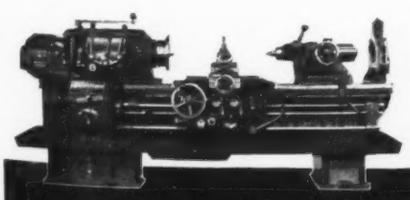
Not only more ....but *Better*



AXELSON 50th YEAR 1892 1942
THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Wherever Axelson Lathes are put to production, executives and operators both *know* from the performance of these precision tools that the finest of materials, the best of workmanship, the most efficient designs will always give a typically Axelson performance—smooth action, no vibration, unfailing accuracy, maintenance held to an absolute minimum. Hence all output from Axelson Lathes is high. But—most important in war plants where interchangeability of parts is vital to mass production—the quality of workmanship, when turned out on Axelson equipment, can be decidedly improved. Evidence of such *better* workmanship appears in the illustration, a practical application of the Axelson slogan, "*There is no economical substitute for Quality.*"

An Axelson precision-operation at a leading aircraft plant. The parts machined are 26" long. A 4-step boring bar with cutters on both sides produces 4 different diameters—**all bored within +.002", −.000" in spite of the fact that boring bar is about 18" long!**



Axelson Lathes are built in 14", 16", 18", 20", 25", and 32" sizes. Your post card will bring you complete details.

AXELSON MANUFACTURING COMPANY

6160 Boyle Ave. (P.O. Box 98, Vernon Station), Los Angeles, Calif.

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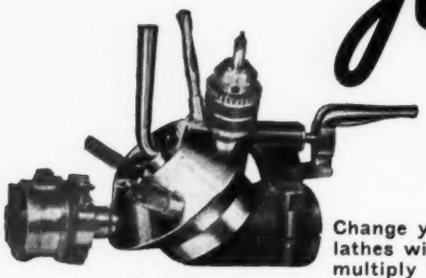
BEFORE YOU BUY ANY LATHE INVESTIGATE AXELSON

PRECISION *Jefferson* TOOLS



Tailstock Turret

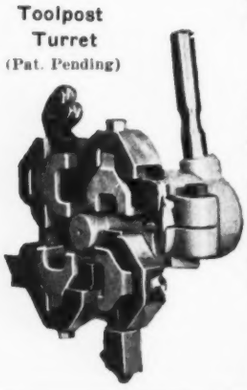
DON'T WAIT FOR TURRET LATHES!

Change your engine lathes to high production turret lathes with Jefferson Turrets. Quickly applied, they multiply the capacity of your machines.

TAILSTOCK TURRET holds 5 tools and centers automatically by means of indexing plunger. Made in four sizes to fit lathes from small bench sizes to those of 20" swing.

TOOLPOST TURRET makes it possible to carry 4 separate tools on tool slide. Made in 2 sizes for standard No. 0, 00, 1 and 2 tool holders. Tools center automatically. Write for folder giving complete description. 15 days delivery.

Toolpost Turret (Pat. Pending)



Increase Capacity at Low Cost!

Use the Jefferson Miller for rapid, accurate operation on toolroom and production jobs. Designed for economy of operation, it is compact yet powerful, with spindle mounted in Timken Tapered Roller bearings, all slides dovetailed, gibbed and hand-scraped to perfect fit and alignment. Table, equipped with 3 T-slots, is 14" x 43/8". Four spindle speeds—200, 400, 700 and 1000 r.p.m., plus powerful V-belt drive, give correct range for a wide variety of jobs. Can be furnished with power feed or quick-acting hand feed in floor or bench type. With or without coolant system. Fully described in Bulletin TD.

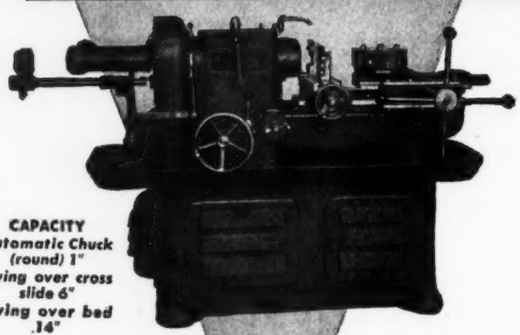
JEFFERSON MACHINE TOOL CO.
673-775 W. Fourth St., Cincinnati, Ohio

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G Back-Geared TURRET LATHE

Timken Bearing

Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

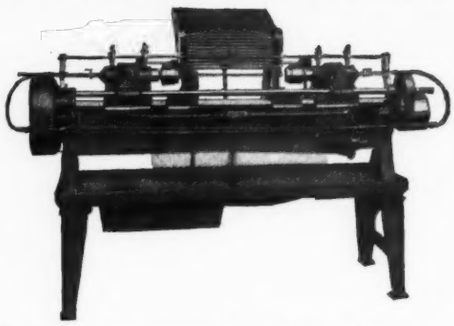
Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

GRANT

DOUBLE END AUTOMATIC THREADING MACHINES



War Equipment Manufacturers!

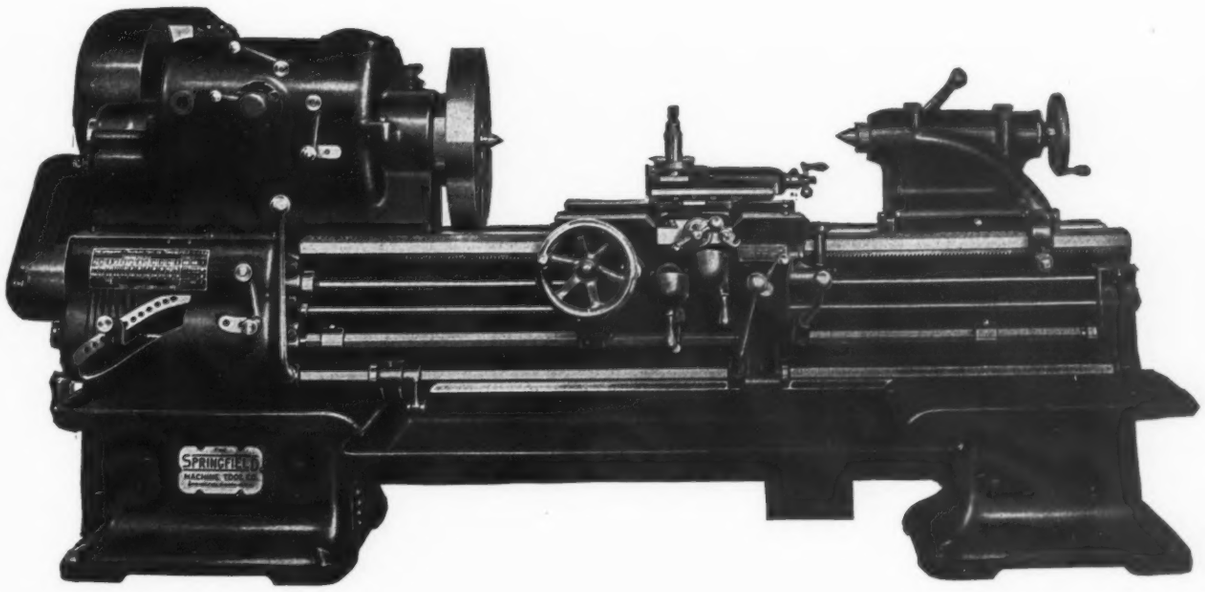
GRANT Double End Automatic Machines are in universal use for tapping, external threading and reaming operations on various types of munitions. Capacities up to 1 1/2" diameter, 72" in length. Send samples or prints and get our detailed recommendations.

THE GRANT MFG. & MACHINE CO.
N.W. STATION, BRIDGEPORT, CONN.

LEAD SCREW TESTED TO 1" 1000 TO THE FOOT...

All Lead Screws are of high carbon steel—tested for accuracy to limits of .001" to the foot—used for thread chasing only, as a feed rod is supplied for all feeds.

The above feature, one of many which account for perfection, is evidence of the qualitative excellence of Springfield Lathes. Even under heavy-duty, continuous war-time pressures, Springfield Lathes are maintaining their "new" qualities, their original accuracies, their inherent abilities to turn out top-grade workmanship. Retool with SPRINGFIELDS . . reasonably early deliveries on priority orders.



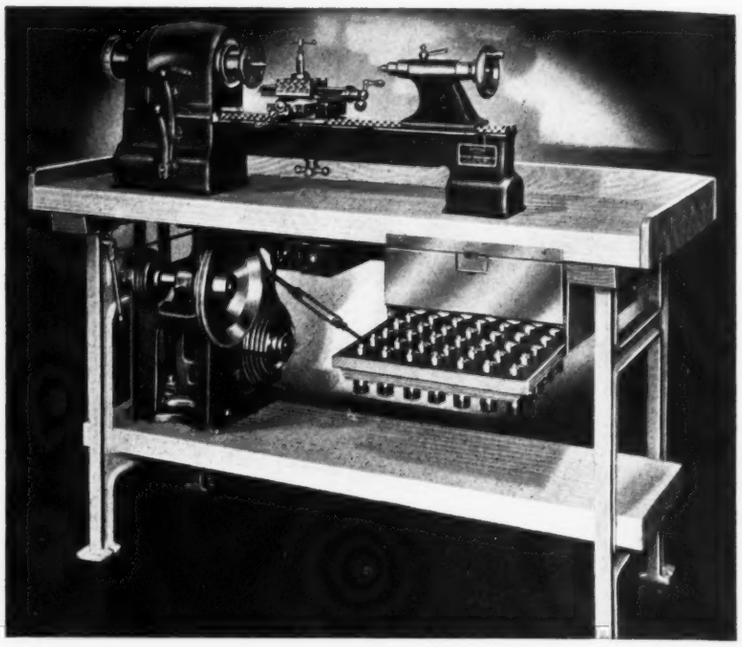
SEND TODAY FOR BULLETIN NO. 162

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD, OHIO

ELGIN

BENCH LATHE UNITS



Featuring two noteworthy improvements for operating convenience! Cap covering driving belts can be quickly removed for changing belts without dismantling the machine. Two lever control — one for low and high speeds and stopping the lathe, the other for forward, reverse and stopping spindle rotation — speeds operation. Built in ½", ¾" and 1" collet capacities. 9" swing. Write for complete specifications.

ELGIN TOOL WORKS

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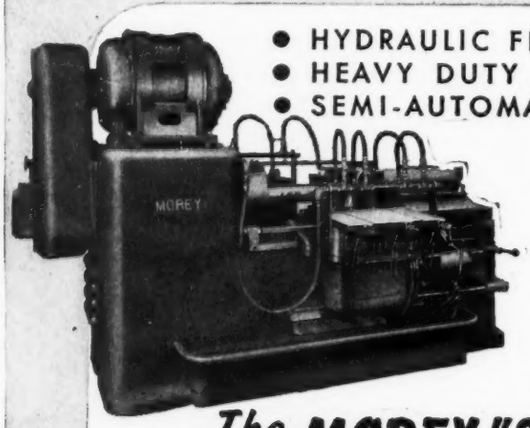
Suitable for 105 M.M. to 155 M.M. Shells



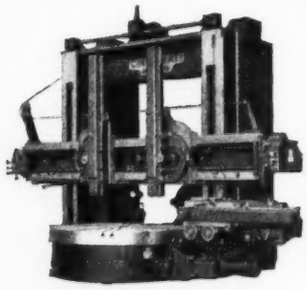
- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle — All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.



VERTICAL BORING MILLS
PLANERS
DOUBLE HOUSING OPENSIDE
CRANK PLANERS
PLANER TYPE MILLERS

THE CINCINNATI PLANER CO.
CINCINNATI, OHIO

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SPEED LATHES
For Lapping-Finishing-Polishing Small Parts
SCHAUER MACHINE COMPANY
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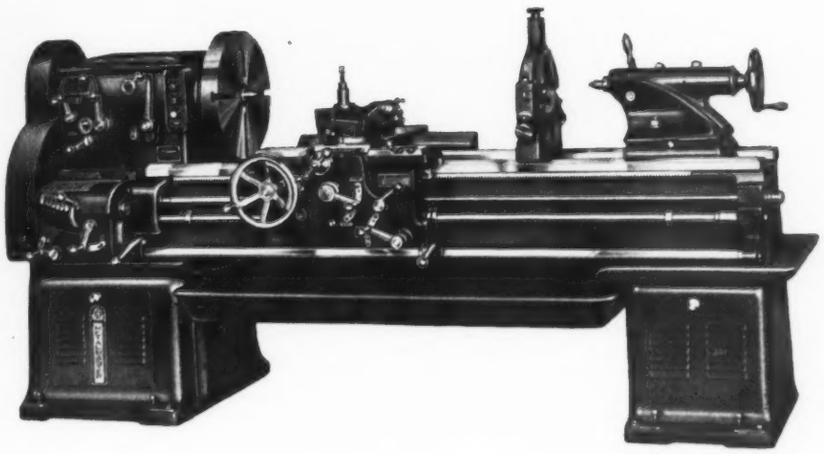
COMMERCIAL TOOL HARDENING AND HEAT TREATING

Strictly Modern Equipment, Backed by the Skill and Judgment of 30 Years Experience. Also, We Sell "Heat-Easy" Compound for Pack Hardening High Speed and High Carbon—High Chrome Steels.

THE BENNETT METAL TREATING COMPANY, Elmwood, Conn.

THE BRADFORD *Metalmaster*



ADVANCED DESIGN FEATURES *Speed* MUNITIONS JOBS!

Faster production — vital on every war production job — must be attained with no sacrifice in precision! The Bradford Metalmaster has been built to meet these needs, incorporating the most advanced features of design.

1840

1942

HEADSTOCK — Nickel alloy steel gears, heat treated, shaved and lapped, give twelve speeds forward and reverse. SPINDLE — Ground and precision mounted to insure perfect running balance. DRIVE — Multi V-belts and oil-immersed clutch permit safe, accurate jogging. QUICK CHANGE BOX — Provides 64 feed changes. LEAD SCREW — Cut on our own screw-cutting lathe to a Pratt & Whitney master screw. APRON, CARRIAGE and BED — all precision fitted and rigidly reinforced.

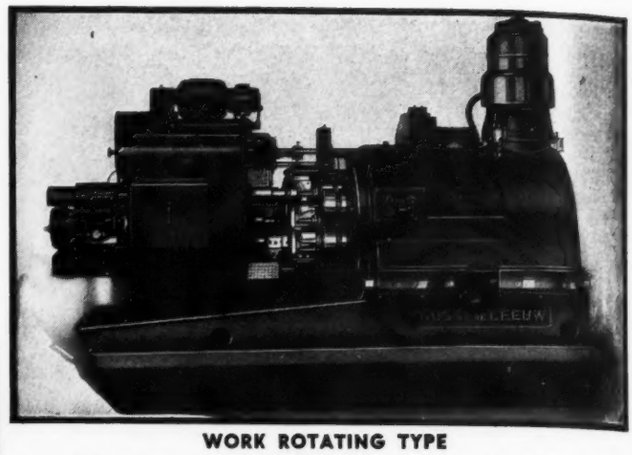
Built to **master** today's toughest jobs, Metalmaster Lathes have plenty of stamina to take on the harder jobs to come. Let us send you complete specifications.

THE BRADFORD MACHINE TOOL COMPANY

657-671 Evans St. Cincinnati, Ohio

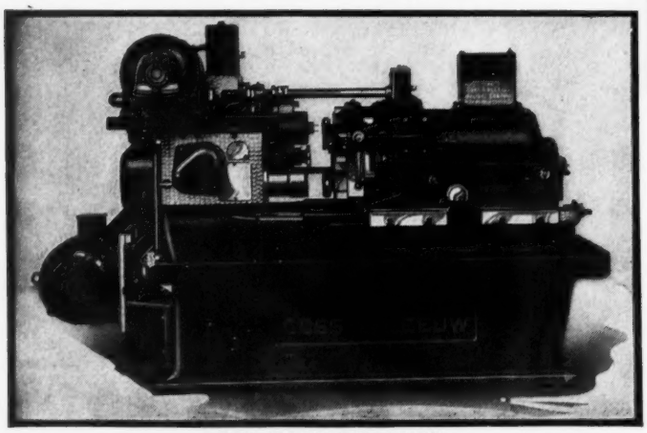
ALSO MANUFACTURERS OF UNITYPE DRILLING AND TAPPING EQUIPMENT AND HYDRAULIC DRILLING MACHINES

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

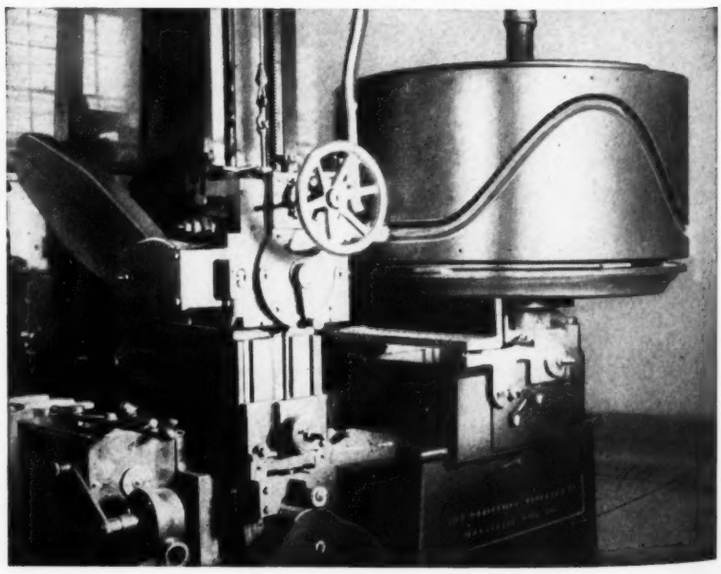
The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

» » Rowbottom for Cams « «

ANY KIND— ANY QUANTITY

One cam or a thousand . . . for conventional or unusual applications... in any size or material—that sums up Rowbottom service! We are cam specialists, making cams and cams only. Our equipment is especially designed and our men are especially trained for the job of cam manufacture. Put these cam experts to work on your problems of cam design and production —and get results.



THE ROWBOTTOM MACHINE COMPANY

WATERBURY, CONN., U.S.A.

"DIFFICULT" JOBS WANTED!

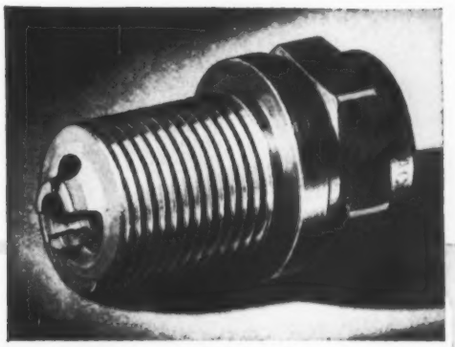
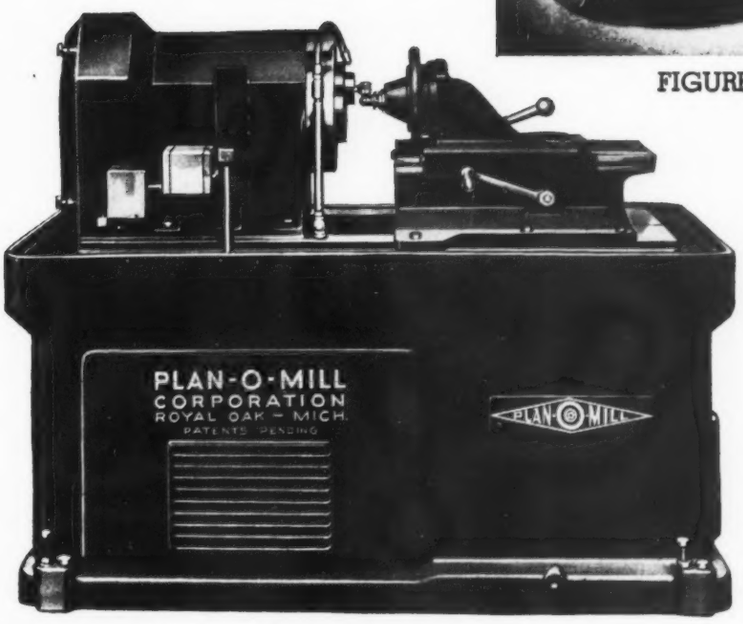


FIGURE 1



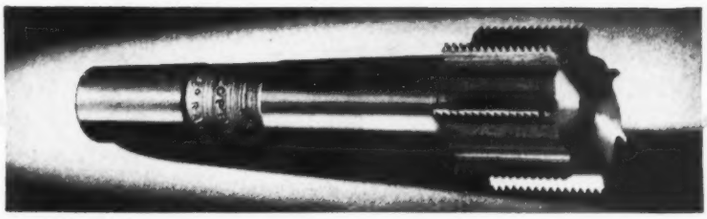


FIGURE 2

● Have you a "difficult" job of threading or cylindrical forming—one where *both* high speed and high precision are required?

Are you interested in saving time—saving material—saving cutters?

Then Plan-O-Mill is your machine!

• • •

In one nationally famous arms plant, spark plugs (Fig. 1) are being threaded by Plan-O-Mill with a cycle time of 35 seconds per piece. Unusual accuracy is obtained. The part does not revolve—all motion is confined to the milling cutter, which revolves around the work.

Cutter life is good. Worked at a 55 parts per hour rate, cutters on this job produce an average of 400 pieces per grind with about 25 grinds per cutter. The one shown here (Fig. 2) has milled more than 10,000 pieces.

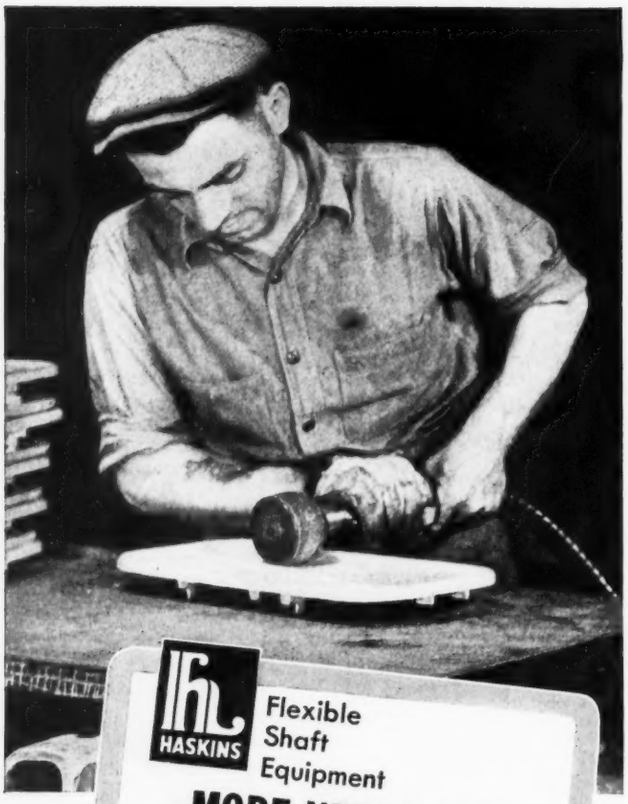
Plan-O-Mill's fast, accurate production makes it the ideal machine for your "difficult" problem.

Write Dept. H for catalog.

PLAN-O-MILL
CORPORATION
(FORMERLY THE GORDON-R CO.)

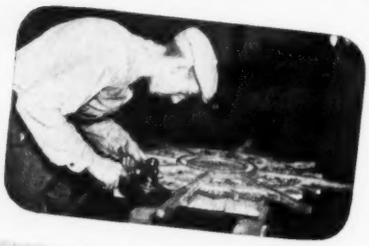
PLAN-O-MILL

WASHINGTON SQUARE BLDG.
ROYAL OAK, MICHIGAN



HASKINS Flexible Shaft Equipment

MORE VERSATILE MACHINES FOR MORE PROFITABLE WORK

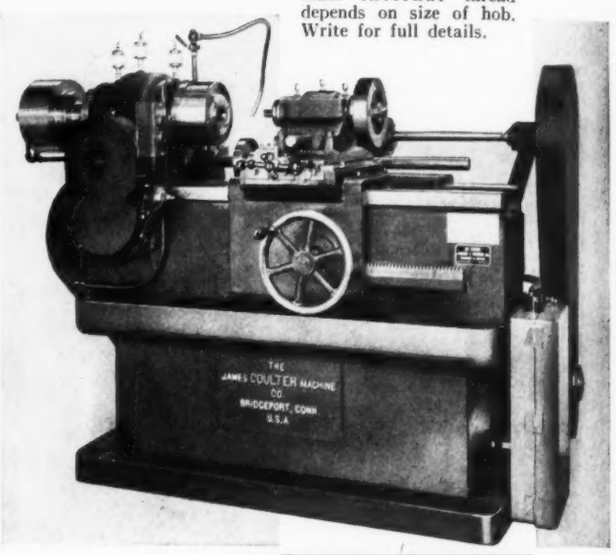


WHERE shop requirements call for continuous work on one operation, there is a type of Haskins Flexible Shaft Equipment especially designed for that particular job. But, taken from job to job, *any one* of the 30 different types of Haskins Equipment will perform *many* kinds of grinding, sanding, polishing, filing and wire brushing—*at lower cost per man and machine hour!* For complete specifications and money-saving ideas, write for Catalog No. 45. R. G. Haskins Company, 617 S. California Ave., Chicago.

HASKINS *Versatile* FLEXIBLE SHAFT EQUIPMENT

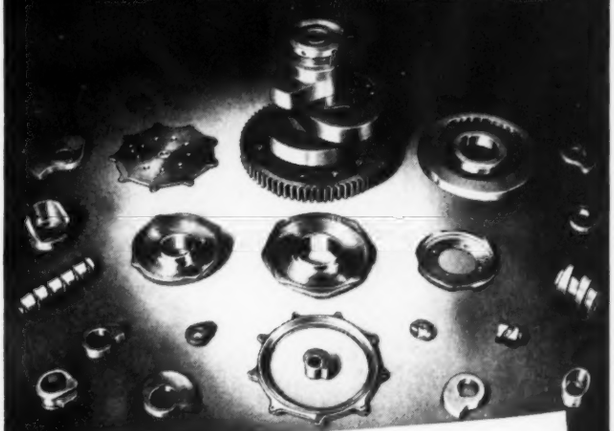
Thread Production at Wartime Speed!

Thread production—internal or external, right or left hand—through automatic, cam-controlled action! In the Coulter Type H Hob Thread Miller work and cutter spindles are individually motor-driven, permitting high output on any type of work that can be chucked. Maximum external thread, 7"; minimum internal thread depends on size of hob. Write for full details.



JAMES COULTER MACHINE CO.
Bridgeport, Conn.

CAMS



LET the largest, most completely equipped cam milling plant in the mid-west handle your cam problems. All sizes of drum, face, groove or other styles of cams cut to order in quantities of one or one thousand. Send specifications or blueprints for a quotation on your requirements.

KUX MACHINE COMPANY
3930-44 W. HARRISON, ST. CHICAGO, ILL.

VERNON

VERNON
NO. 0 PRECISION
HORIZONTAL MILL

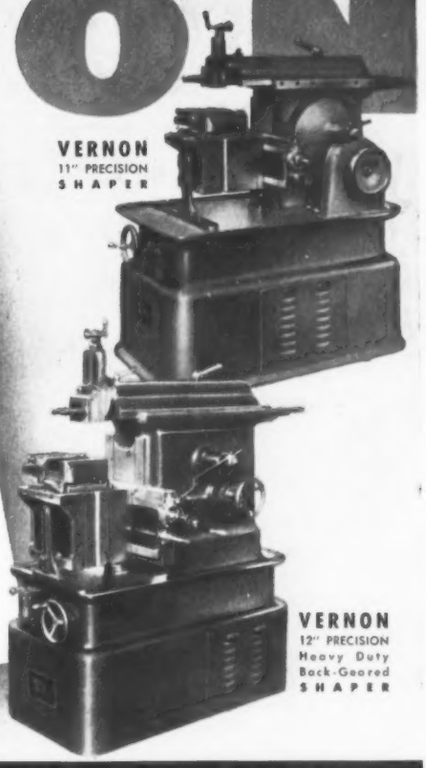
VERNON
VERTICAL MILL
AND JIG BORER

SIMPLICITY
Because all Vernons are simply designed, new help finds them easy to operate, quickly bringing production to peak machine capacity.

EFFICIENCY
Compact design saves valuable floor space. Low consumption power plants drive through heavy cuts. Modern drives provide wide speed range, and quick changes.

SAFETY
All Vernons are designed with safety in mind. Fully enclosed drives prevent injury from open belts and pulleys.

★ Bulletins are available on each Vernon tool, write today!



VERNON
11" PRECISION
SHAPER

VERNON
12" PRECISION
Heavy Duty
Back-Geared
SHAPER

See the VERNON LINE—Dealers in all important industrial areas. Deliveries are being made Promptly!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON - LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

BETTER Small Part Production

with THE

Get better production and release larger machines for large work! Use the Frew Hand Miller for accurate, economical production of small parts. Heavy construction and "big machine" features guarantee accuracy on heavy cuts. Table size 16¾" x 5¾" makes a wide range of work possible. V-belt drive and Timken-equipped spindle assure smooth operation at all speeds.

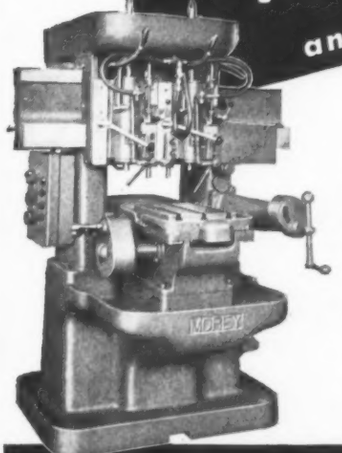
FREW

HAND MILLER

THE FREW MACHINE CO. 132 W. VENANGO ST. PHILADELPHIA, PA.

Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER



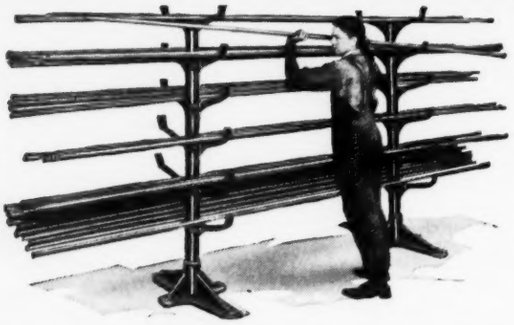
Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

A TIME SAVER



THE BROWN SECTIONAL RACK

saves the time wasted by your men in end hauling Bar Iron, Pipe, etc., for ten to fifteen feet when stored in the ordinary closed-side Rack; the Brown Rack requiring a short side movement of but a few inches. Its various compartments enable you to segregate your diameters and lengths into a systematic arrangement. Your Store Keeper can make up orders for new stock more quickly and accurately. Excessive stock is rendered visible to the head of the department. Built in five styles from metal, it cannot warp, sag or burn. Being sectional, it can be expanded indefinitely. *Send for Bulletin No. 26-M.*

BROWN ENGINEERING CO. 131 N. THIRD ST. READING, PA.

Accurate, High-Speed

MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE
14" STROKE

SELF-CONTAINED MOTOR DRIVE

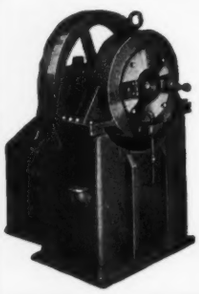
power rapid transverse feeds in all directions

Timken Tapered Roller Bearings for Main Spindle—all others anti-friction.

Built to highest accuracy standards the MOREY VERTICAL SHAPER is simple for tool-room manufacturing. Power feeds and power rapid transverse feeds in all directions are instantly available in all operating positions.

Ask for Circular 726

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.



Swaging—*What* it is and *How* it is done on

TORRINGTON SWAGING MACHINES

All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

Examples of many possible operations by the Rotary Swaging Method:—

1 Point rods for drawing
2 Pointed rods and tubing
3 Tapered rods and tubing
4 Acetylene torch tips
5 Curling iron tubes
6 Bonding Ferrules to cables
7 Steel furniture legs
8 Tap blanks
9 Banding Rotating Bands on shells
10 Meat hooks
11 Refrigerator expansion bulbs
12 Sizing and Reducing wire

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

THE TORRINGTON CO.
55 Field Street Torrington, Conn.

BURKE

MILLING MACHINES and ATTACHMENTS

Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3 and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

Burke Machine Tool Co.
297 E. 16th St., CONNEAUT, OHIO

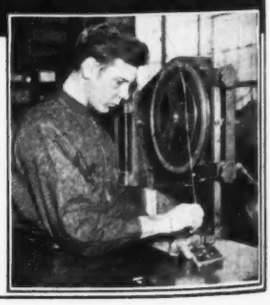
GROB OPEN END SAW

NO SAW WELDING

Instant Internal Sawing

Unsurpassed in speed, efficiency and accuracy of sawing small and medium sized dies as well as miscellaneous parts.

Write or Wire for Details and Prices



GROB BROTHERS
GRAFTON WISCONSIN

Peerless Saws are Helping to Save — TIME ... METAL ... and BLADES

PEERLESS 14" High Duty Saw, cutting butt end from 155 mm semi-finished shells. As many as 800 pieces are cut with a single, high-speed, 4 tooth, $1.50 blade.

American tools and free Americans have created a miracle of mass war production . . . have set an impossible pace for Axis slaves to follow. To help these free men produce, Peerless has made practical the faster cutting of metal.

Faster cutting has been made practical with a Peerless — the Saw with the exclusive Four-Sided Saw-Frame, and Backing-Plate Blade-Support. Besides reducing CUTTING TIME; Peerless Saws save METAL, too. The thin, cool-running, straight-cutting blade removes as little as 1/16" of the stock.

BLADE SAVINGS also count up fast in triple-shift, high speed cutting. On a Peerless High Duty as many as 800 butt-end shell cuts are being made with a single blade.*

These savings in TIME . . . METAL . . . and BLADES are helping free men to win, and to buy their War Bonds every pay day. More complete details on this 3-way saving will be mailed at your request.

PEERLESS MACHINE COMPANY • RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. M-842, Racine, Wisconsin

*Mail complete details on the performance record shown above.....

☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City..... State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

For Speeding Plant Conversion—
MOTCH & MERRYWEATHER COLD SAWING MACHINES

First, the change-over to war production. Then, a mounting determination to turn out more and *more* and *still more* materiel. In these procedures the cold sawing of metal holds an increasingly important place. Motch & Merryweather Cold Sawing Machines can greatly simplify your plant conversion and then lift your production rate because of five proven qualities:

Accuracy. The M & M Cold Saw delivers consistently square sections without chatter or burr, without variation, and without scrap.

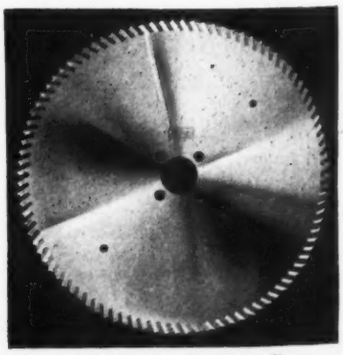
Speed. You get steady cutting speeds up to 1-1/2 times the highest rate ever attained before. "Amazing!" technicians declare.

Flexibility. Available is a range of attachments for the single or multiple cutting of practically any metal, ferrous or non-ferrous.

Capacity. Two sizes, the No. 3 and No. 4, handle round stock up to 16" and squares up to 14-1/2".

Stamina. You can run the M & M Cold Sawing Machine to capacity 168 hours a week and keep it up indefinitely. Ask for our bulletin.

Motch & Merryweather Cold Sawing Machines have speeded the cutting of billets for gun barrels, of shell slugs and other items of war production.



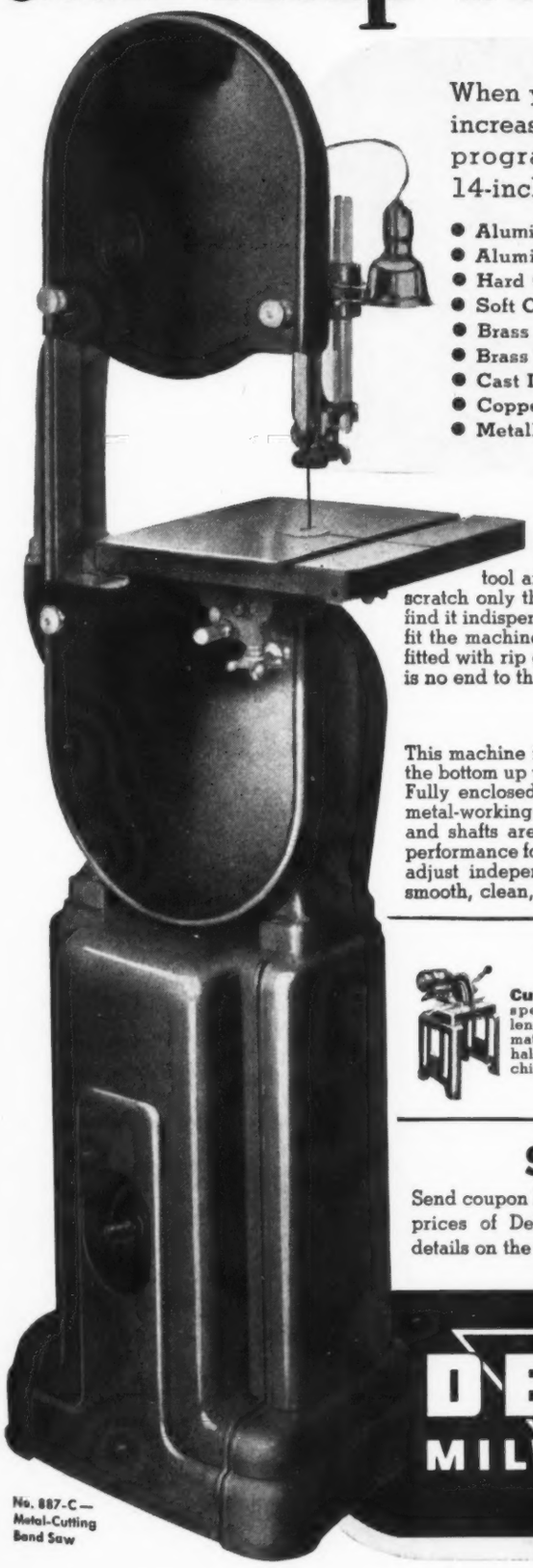
Motch & Merryweather Saw Blades fit any standard machine. They excel in design, fit, workmanship, cutting speed and endurance. Sizes, 26", 28", 30", 38", 42", 44".

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
Penton Building . . . Cleveland, Ohio

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER THE MACHINERY CO
CLEVELAND CINCINNATI DETROIT PITTSBURGH

These Low-Cost METAL-CUTTING BAND SAWS Can Help You *Right NOW*



No. 887-C — Metal-Cutting Band Saw

When you are confronted with an urgent need for immediate increased production in connection with the U. S. armament program — check into the possibilities of using this 14-inch Delta metal-cutting band saw. It is ideal for cutting

- Aluminum Castings
- Aluminum Sheets
- Hard Cast Brass
- Soft Cast Brass
- Brass Sheets
- Brass Tubing
- Cast Iron
- Copper
- Metallic Hose
- Cold Rolled Steel
- Carbon Tool Steel
- Bronze & Manganese
- Drill Rods
- High Speed Steel
- Monel Metal
- Nickel Steel
- Iron Sheets & Bars
- Pipe
- Malleable Iron
- Babbitt
- Bakelite & Molded Plastics
- Asbestos & Felt
- Brake Linings
- Fibre & Mica
- Slate & Transite
- Hard Rubber

Will Help Speed up Production

There is no limit to the number of jobs you can find for this economical low-cost tool around the general tool and machine shop. And the few uses mentioned above scratch only the surface of the machine's adaptability. Die casters and molders of plastics find it indispensable for trimming work. The miter-gage groove in the table makes it easy to fit the machine with fixtures for cutting tubing, etc., on a production basis, and it can be fitted with rip gage for cutting strips from sheet metal. Once the machine is installed, there is no end to the number of jobs that are found for it!

Many Basic Advantages

This machine is not just another metal-cutting saw—but represents sound designing from the bottom up with many new basic features. Double trunnions provide rigid table mounting. Fully enclosed gear-drive, running in oil, is mounted directly on base of machine. Four metal-working speeds. Can be switched easily into high speed for soft materials. All wheels and shafts are carried on New Departure self-sealed ball bearings, insuring trouble-free performance for the entire life of the bearings. The guides, unlike those in ordinary machines, adjust independently of each other, are made with micrometer accuracy; and provide smooth, clean, accurate cutting.

OTHER DELTA LOW-COST MACHINES

Cut-Off Machine cuts speedily and to exact lengths a wide variety of materials. Priced at one half the usual cost of machines of this type.

A complete line of single and multiple spindle 14" and 17" drill presses in slow and high speed models.

Bench and Pedestal Grinders "that never forget their goggles"—the safest, most accurate and efficient grinders made.

Send for CATALOG

Send coupon below for latest Delta catalog giving full specifications and prices of Delta 14-inch Metal-Cutting Band Saw. Also prices and details on the complete line of Delta low-cost machines.

DELTA Quality PRODUCTION TOOLS

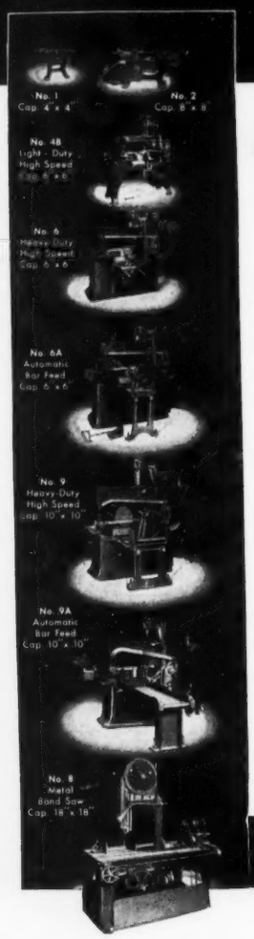
DELTA MILWAUKEE

THE DELTA MANUFACTURING COMPANY
605-D E. Vienna Avenue, Milwaukee, Wis.

Please send me catalog of Delta Machines, giving specifications and prices on Delta Metal-Cutting Band Saws. I am also interested in ☐ Delta Cut-Off Machines ☐ Delta Drill Presses ☐ Delta Grinders ☐ Delta Power Feed Drill Presses.

Name .....

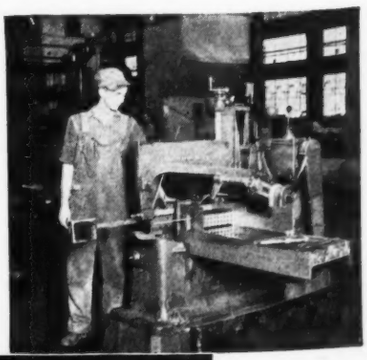
Address .....



MARVEL SAWS

One of these saws "paid for itself in 3 months on two storehouse orders" in a prominent Railroad Shop

Innumerable locomotive shops have modernized their cutting-off methods by installing MARVEL Hack Sawing Machines. While the selection of the saws for each shop depends largely on the capacity range of the work to be encountered in the individual shop, the saws illustrated are typical selections: A No. 18 MARVEL Giant Hydraulic (capacity 18" x 18") shown above for cutting large size bars, billets or forgings, such as locomotive axle stock; and a No. 9A MARVEL Ball Bearing High Speed Hack Sawing Machine (capacity 10" x 10") equipped with an automatic bar feed, illustrated at right, cutting-off 8" stay bolts from 1" bars, 27 at a time.



ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. CHICAGO, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York

ARMSTRONG-BLUM MFG. CO. "The Hack Saw People"
5700 Bloomingdale Ave., Chicago, U. S. A. Eastern Sales: 225 Lafayette St., N. Y.

Cleared for

ACTION

. . . and keeping pace with the ever increasing performance of our Air Force, are these 3 Spindle-No. 3 MA-6 (capacity of 1¼") cast iron, ball bearing Drilling Machines. Equipped with Aveymatic Power Feed.

THE AVEY DRILLING MACHINE CO.
CINCINNATI OHIO U. S. A.

Avey DRILLING MACHINES

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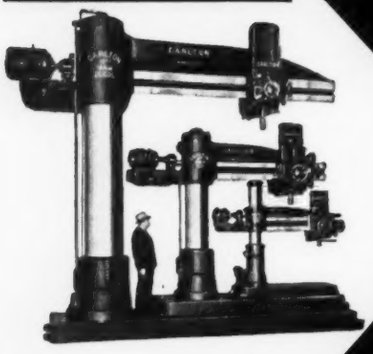


CARLTON RADIALS

» Low hung drive to spindle—for accurate, vibrationless operation . . . All power-driven parts running in oil—insures quiet operation at all speeds . . . Concentrated and conveniently located controls—speeds up operation . . . Constructed on unit principle with carefully designed reinforcements. Write for full description of Carlton All Ball Bearing Radials.

THE CARLTON MACHINE TOOL CO., Cincinnati, O.

The SKILL needed in tapping is BUILT RIGHT INTO THIS

Ettco-Emrick FOOT-OPERATED TAPPING MACHINE

That's why *unskilled labor* can give you such high tapping production on this machine—*2400 accurately tapped holes per hour* with the standard 2-spindle head as shown—and up to *12,000 per hour* with available Ettco-Emrick Multiple Tapping Heads. All the operator has to do is place the work and step on the foot pedal. The design eliminates the human factor from the actual tapping operation.

FOR FULL DETAILS WRITE FOR THESE 2 BULLETINS

BULLETIN NO. 4 covers the Machine and **BULLETIN NO. 3** the Multiple Heads.

Copies Mailed to You on Request.

ETTCO TOOL CO., Inc.

592 Johnson Ave., Brooklyn, N. Y.
Detroit • Chicago

MAKERS OF Ettco-Emrick DRILL CHUCKS • TAP CHUCKS MULTIPLE TAPPING AND DRILLING HEADS TAPPING ATTACHMENTS • TAPPING MACHINES

KEYSEATING (and other jobs) AT WARTIME SPEED!

Plants engaged in war production are keeping Davis Keyseaters busy on a variety of jobs. The tilting table, high capacity, and quick set-up features make them extremely versatile, useful for many jobs in addition to keyseating. And the Davis broaching pull cut saves time on every job! Write for full details.

DAVIS KEYSEATER CO.
405 Exchange St., ROCHESTER, N. Y.

SAWS for ALL METALS

Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.
ROCHESTER NEW YORK

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.
CLEVELAND, OHIO, U. S. A.

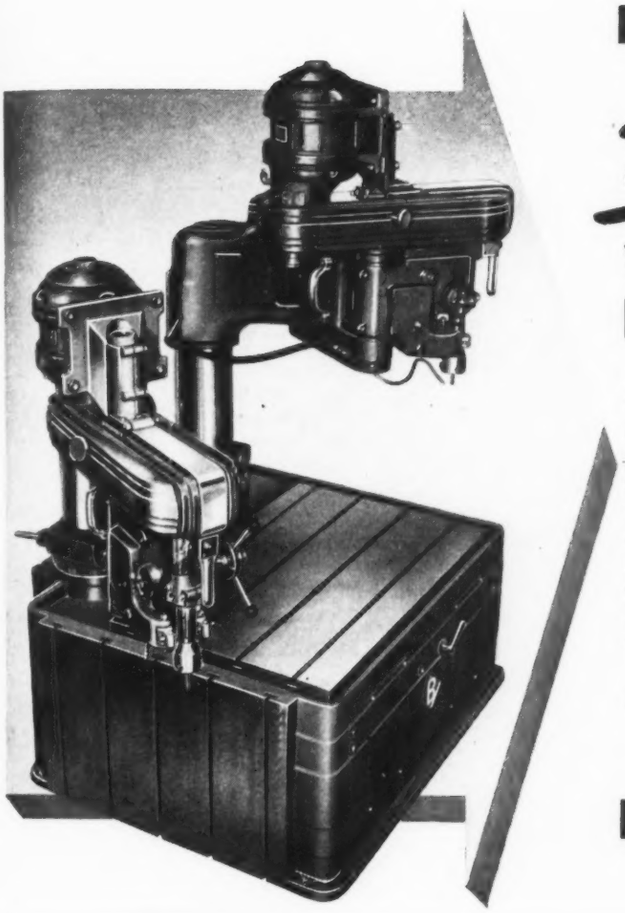
NOW AND ALWAYS OF

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines

(Automatic and Semi-Automatic)

LELAND GIFFORD CO.
WORCESTER, MASS.



Double Production

with this dual head precision Bakewell Tapping Machine

Another case where two heads are better than one!... The new dual head Bakewell Radial Tapping Machine doubles the exactness of work, the convenience and time saving qualities of the single head machine. Each tapping head is independently operated for Class 3 or 4 Fits on big, bulky pieces of work. Each has exclusive Bakewell lead screw feed control that eliminates rejects—saves invaluable time. Patented clutches save your taps, too!

There's the correct model Bakewell for every tapping need where speed and precision are required.

write for catalog

BAKEWELL MANUFACTURING CO.
2427 EAST 14TH ST. • LOS ANGELES, CALIF.

Cross section of Tru-Grip Tap Holder showing positive drive to tap.

Here's How to Get More Efficient Tapping at Lower Cost

Here's why Procunier Tapping Heads give this to you

The exclusive advance design of the new Procunier Tapping Heads assures you accurate tapping at high speeds with automatic protection for taps! Tap is driven by a double-cone, cork-faced friction clutch which automatically regulates tap driving power by pressure applied through the drill press spindle. Operators can quickly detect dull or loaded taps by the "feel," or pressure on the clutch, required to drive them, thus avoiding needless tap breakage. With this sensitive Procunier smooth-operating friction clutch, bottom tapping is as simple as through tapping, since the clutch instantly slips should the tap strike bottom or stick due to tap loading. Built to stand up under hard service. Many other features. If you want to reduce your tapping costs

SEND FOR BULLETIN

giving full details, description and prices on complete line of Procunier Precision Tapping Heads to meet all needs. The new Tru-Grip Tap Holder —and also the full line of Procunier Universal Tapping Machines, hand or foot operated.

Procunier Safety Chuck Co.,
16. S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads. ☐ Tru-Grip Tap Holders. ☐ Universal Tapping Machines.

Name .....

Address .....

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago, Ill.

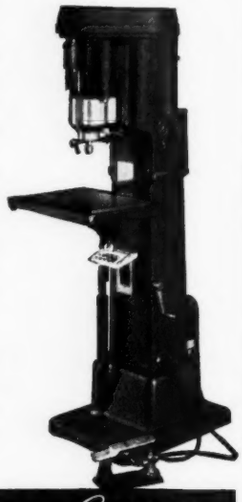
After the Emergency ... What?

Tooled today for war time aluminum fuse bodies, this *standard* Haskins Tapper can quickly and inexpensively be changed over to peace time production needs.

It's natural today to think of machinery in terms of *immediate* output. But when the war's over—what then?

That is when the *lasting* quality of really fine equipment will pay its greatest return.

Haskins Tappers bought today for war time production are *standard* machines. A few quickly made adjustments — perhaps an inexpensive fixture change—and your Haskins Tappers will be ready to help you hold *down* peace time production costs—so that you can keep sales and profits *up!* R. G. Haskins Company, 618 S. California Ave., Chicago.



WRITE FOR BOOKLET —"Holding Fixtures for Haskins Tapping Machines." Contains many new ideas.

HASKINS

HASKINS *Precision* TAPPING EQUIPMENT

Babbitrite

The COMMON SENSE RETAINER IN POURING MOLTEN BABBITT METAL

OR LOW TEMPERATURE BISMUTH ALLOYS

Write for Free Test Sample

BABBITRITE eliminates blowouts avoiding serious injuries to workmen and costly disruption of work.

Comes ready for use, saves preparation as is necessary with clay and putty. Can be used 100 times. Will not harden.

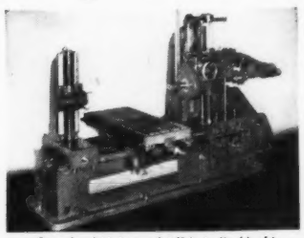
Will not injure hands. More economical to use. Sold on money-back guarantee.

LITERATURE ON REQUEST.

PRODUCTS MFG. CO.
329 N. MILWAUKEE STREET MILWAUKEE, WIS.

UNIVERSAL *Horizontal Boring Machine*
The only **TRIWAY** *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

The BARNES Motor Driven Precision Cutter Grinding Machine

For Precision Grinding Formed Milling Cutters Used in the Manufacture of Rifles, Pistols, etc.

Write for bulletin giving complete description.

GENERAL MACHINERY CORPORATION
140 Federal St., BOSTON, MASS. Telephone Liberty 4826

SMITH & MILLS
CRANK SHAPERS
Sizes 12" to 32" stroke
THE SMITH & MILLS CO., Cincinnati, O.

Here's the Way to Do the Internal Grinding of TUNGSTEN STEEL Cartridge Dies

These NORTON DIAMOND WHEELS *are the Answer*

Rapid Production
Close Dimensional Acccuracy
High Surface Finish

FOR ROUGHING—Norton 100S-B100 Diamond Resinoid

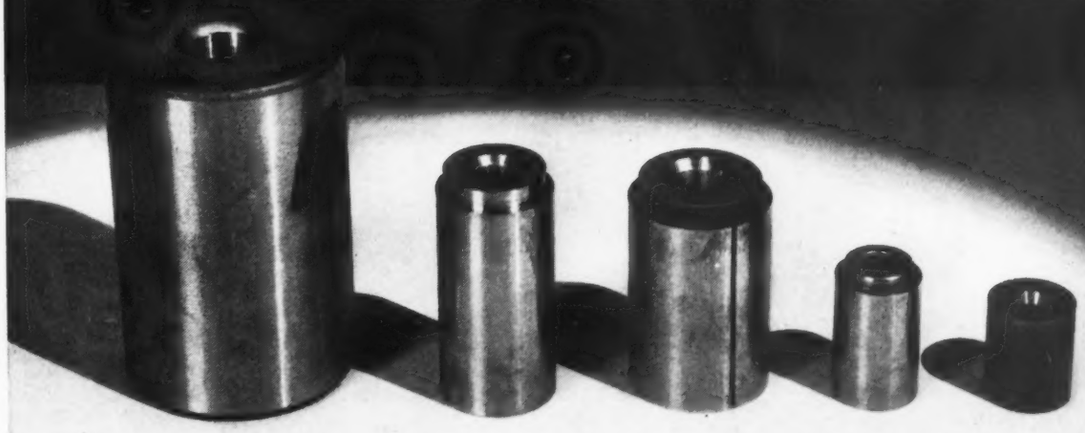
Grinds cartridge dies of dense, wear-resistant alloy steels such as tungsten at a rapid rate, many times faster than ordinary vitrified wheels. Wheel wear is so slight that hole size and straightness can be held to close tolerances without difficulty.

FOR FINISHING—Norton 500-B50 Diamond Resinoid

Produces a surface finish comparable to that obtained by lapping and in a fraction of the time.

If you are making tungsten steel cartridge dies it will pay you to consider Norton Diamond Wheels for the internal grinding job. Consult your Norton abrasive engineer.

NORTON COMPANY, WORCESTER, MASS.



NORTON ABRASIVES

W-883

For production-plus
Simplicity of operation
Extreme precision
Versatility

ARTER ROTARY SURFACE GRINDERS

You can depend on Arter Rotary Surface Grinders to improve finish, cut costs, because they are made for fast, close tolerance work.

Arter grinding engineers are always ready to study your grinding problems and tell you how to get maximum precision production.

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

SUPERIOR IN

Construction
Capacity
Convenience

GREENFIELD UNIVERSAL TOOL GRINDERS

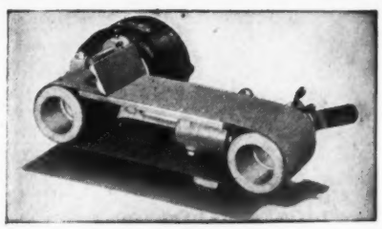
Rigidly constructed—heavy enough for production work! Versatile — capable of handling all types of reamers, drills, taps and cutters! Convenient—easily set up with a minimum of attachments, easily controlled from one position! The No. 3 Motor-in-head Universal Tool Grinder can handle a wide variety of tool sharpening or tool-room grinding jobs. Write for illustrated bulletin giving full details.

PRODUCTION MACHINE CO.

GREENFIELD, MASS.

NOW!

An *Inexpensive* **ABRASIVE BAND GRINDER—**



"Built Like a Machine Tool"

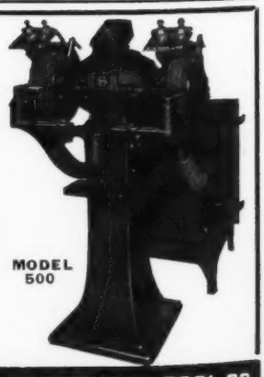
The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on belt. Ball bearing throughout, equipped with Alemite lubrication, complete with grease gun. *Write for illustrated folder on this and other styles and sizes.*

HORMEL-M GRINDER

WALLS SALES CORP., 96 Warren St., NEW YORK, N. Y.

Captures
Dust and dirt
Releases
More Time for work

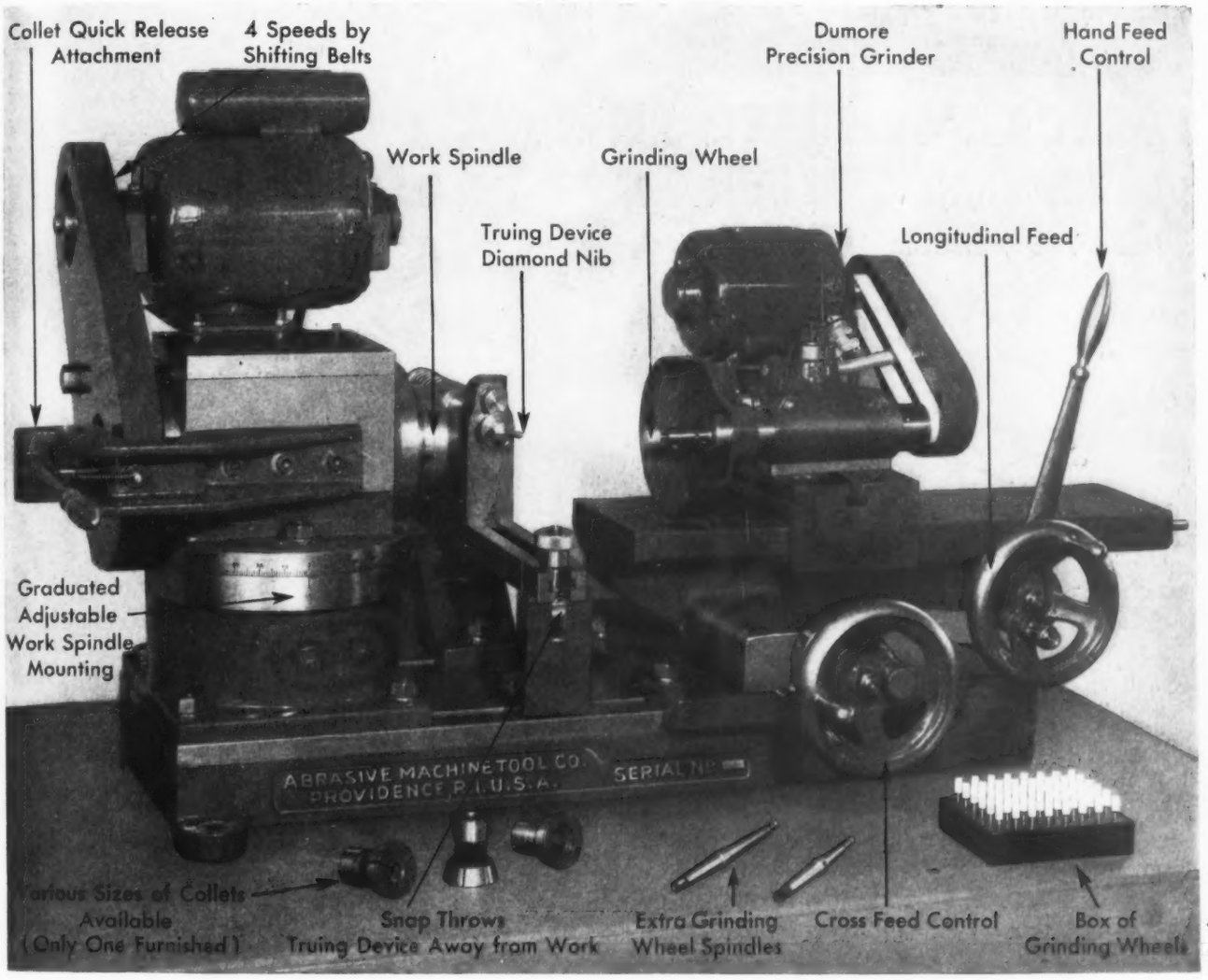
"UTILITY" GRINDER



Motor-in-Head; Self-contained dust collector. Ball-bearing; totally enclosed motor; adjustable tool rests. Write for interesting details.

THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO, U.S.A.



The NEW Abrasive No. 1G Internal Grinder

The ABRASIVE No. 1G has been developed recently to handle the large volume of manufacture requiring a highly accurate, easily handled, internal grinder. Typical of such work is the huge quantity of die work, particularly those used in bullet and cartridge manufacture.

This machine will grind holes up to 12" diameter, has a longitudinal travel of 8", and spindle cross feed of 3 1/2". Cross Feed is provided with hand wheel graduated .001". Longitudinal Feed has graduated hand wheel .001" and positive stop with micrometer adjustment.

These close graduations PLUS the rapid acting draw-in collet, and the quick operating hand feed, make the No. 1G an extremely handy and accurate tool. It can be used also for external or cylindrical grinding within its capacity.

This Grinder is manufactured under the same careful supervision as the ABRASIVE Surface Grinders which have been known for years for their accuracy.

Study the illustration — then write for any further information, including price and delivery. Address—

ABRASIVE MACHINE TOOL COMPANY

Dealers in Principal Cities

EAST PROVIDENCE · · · RHODE ISLAND

PREVENT BOTTLENECKS AT POINTS OF FINAL ASSEMBLY

FOREDOM'S MODEL 111 *Flexible Shaft* GRINDER KIT

Industry's Versatile "First-Aid" Tool

Model 111 licks those LITTLE JOBS which frequently become BIG BOTTLENECKS. Modern war implements require the use of many millions of small parts and fittings, many of which because of irregular shapes, cannot be finished by conventional set-ups, or must be touched up during final assembly. That's why this tool is indispensable to every plant. The Model 111 is the handiest little "pinch-hitter" that ever came industry's way.

HUNDREDS OF USES WITH MODEL NO. 111

Even if the plant has heavier types of flexible shaft tools, the FOREDOM offers the advantage of accurate, sensitive control through its sturdy pencil-size hand-piece. Gets to hard-to-reach places . . . time and again saves an expensive disassembly and reset . . . has dozens of tool-room and maintenance uses . . . keeps work well in view.

SPOT MODEL 111 at CONVENIENT POINTS ABOUT YOUR PLANT

Promote efficiency and save steps by spotting Model 111 Kits at convenient points about your plant. Their modest cost makes it possible to place one at each point of final assembly. Many will be the times they'll "save the day."

PENCIL SIZE HANDPIECE

3-WAY USABILITY

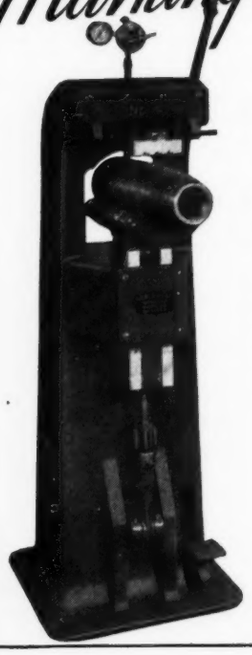
Model 111 can be used at the bench—suspended from any convenient hook — or slung from operator's shoulder by slipping a strap through motor hanger. At its low cost, Model 111 frequently pays for itself on one job. Complete with case and accessories.

$23.50

For Complete, Illustrated Information Write for Catalog 361

FOREDOM ELECTRIC CO.
27 PARK PL., NEW YORK, N. Y.
SINCE 1921

Marking Keeps Pace



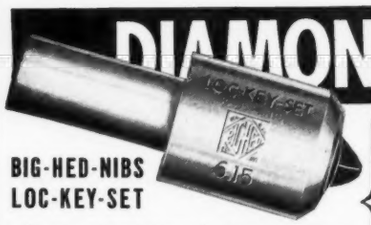
Keeps pace with orders, and with other stepped-up operations — when you mark with Noblewest Rapid Precision equipment. More and more manufacturers entrust their marking operations to Noblewest equipment because of its accuracy, speed and dependability —the result of long experience and continued engineering research. Why not entrust us with your marking requirements?

Accessibility. Popular Model No. 4, showing wide opening for quick feeding of shell bodies Today universally used in defense industries. Can be tooled for hundreds of applications.

NOBLE & WESTBROOK MANUFACTURING CO.
Marking Specialists Since 1904
EAST HARTFORD, CONNECTICUT

MARK IT BEST WITH NOBLEWEST — NOBLEWEST IMPROVED MARKING DEVICES

DIAMONDS for Victory



BIG-HED-NIBS
LOC-KEY-SET

RE-SET-ABLE
Cooler dressing
Closer Tolerances
Micrometer Accuracy
Because: Wing key heat dissipation and absolute diamond lock nib.

• Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.) Grinders instruction card free.

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
930 E. 41st Street CHICAGO, ILL.

Superbly Accurate, Speedy and Convenient

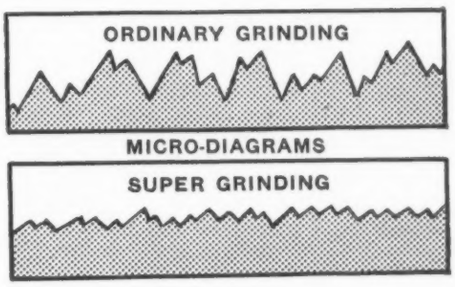
WARDWELL No. 57T Automatic Circular Metal Saw Grinder

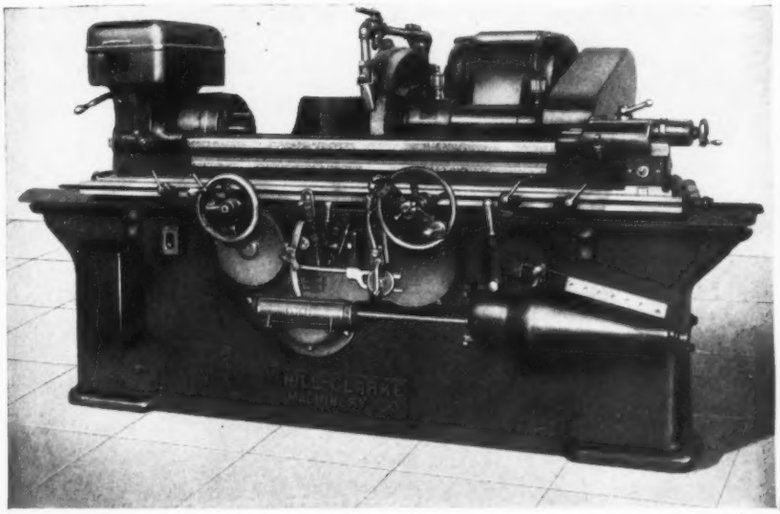
Fully automatic and precise sharpening of slitting and screw slotting Saws and Milling Cutters. Capacity includes saws up to 8" in dia., in range up to 3¾" thick. Automatic indexing and accuracy within ± .001" of exact diameter of entire lot. This Machine pays for itself many times over — a "must" for Economy in high production shops. Illustrated Bulletin gives all details.

THE WARDWELL MFG. CO.
3168 Fulton Rd. CLEVELAND, OHIO

HILL-CLARKE *Super Grinding*

The peaks and valleys of ordinary grinding surfaces are non-existent on the MICRO-FINISHES obtained from the use of HILL-CLARKE Grinders. Super Grinding to a Micro-finish surface requires no extra grinding time—employs a regular grain, free-cutting wheel—follows the same procedure used in routine commercial grinding—produces fine finishes to precision limits, measurable in micro-inches.





HILL-CLARKE
10' x 50' GRINDER

illustrated at the left. This and other Hill-Clarke Grinders perform at routine commercial production speeds to obtain the micro-finish illustrated above. Extreme care in the precision construction of these Grinders provides the rigidity and smoothness-of-action necessary to obtain this fine finish. Write for catalogue on Hill-Clarke Grinders.

HILL-CLARKE MACHINERY CO.
648 Washington Blvd.
CHICAGO, ILL.

THEY STAY TRUER . . . LONGER

High quality grinding becomes high economy grinding with VITRIFIED WHEELS. They stay truer—longer. They will not gum or glaze. And they are not affected by heat, cold, oils, or acids.

Let our engineers study your grinding jobs and make recommendations for greater service and economy. No obligation, of course.

VITRIFIED WHEEL CO.
Westfield, Mass.

The REID 2-B All Electric Automatic and Hand Feed Surface Grinder

THE Reid All Electric Surface Grinder is equipped with a motorized spindle, thereby eliminating all belts, pulleys, and counterweights. Table and cross slide are equipped with oil rollers, insuring greater life and proper lubrication. Table is operated with a silent chain instead of rack and pinion gears. Grinding capacity 6 x 18 x 11. Additional height if required on all standard machines. Send to Dept. M. for descriptive literature.

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Full Hardened—then Drilled at Assembly

4 Countersunk 1/2" Holes in 12 Minutes in Hardened Work Spindle for Threadmill.

● Any drill press operator can drill, countersink and counterbore hardened steels with "HARDSTEEL" drills and produce accurate, smooth holes quickly and with an ease that will amaze you.

No annealing—no grinding—no rehardening—no distortion. A boon to die makers—a production tool that is changing shop practice in hundreds of plants.

Used with standard drill presses and jigs. Easy to regrind. Sizes 1/8" to 1" from stock. Special sizes to order.

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You harden it—we'll drill it—with "HARDSTEEL"

The "HARDSTEEL" Instruction Handbook tells how. Write for a copy—

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Hand Cut High Speed Steel

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We manufacture a complete line of rotary files and rotary rasps with a large stock of all sizes and shapes. We can supply any special size or shape desired.

Write for complete catalog illustrating all types, kinds and shapes of files, also flexible shaft machinery and equipment.

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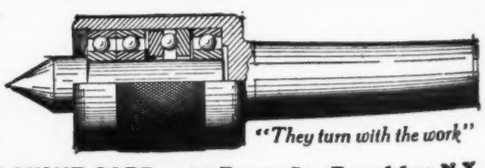
"ALIVE" Ball Bearing Centers



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—ACCURACY OF THREADS—LOW CHASER COST—ALL AROUND DEPENDABILITY. Bulletins available: General Purpose Die Heads, Insert Chaser Die Heads, Threading Machines.

THE EASTERN MACHINE SCREW CORP.
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See our Advt. on Page 469 July Machinery

SECOMET Resinoid Bonded Diamond Wheels can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-bladed tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation. Catalog on request.

Prompt deliveries

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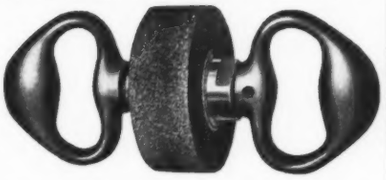
CRACKERJACK!

The Newest Ball-Bearing Grinding Wheel Dresser



Made in single handle, double handle and tool post types, Desmond "Crackerjack" is the latest addition to our *complete* line of wheel truing equipment. Write for our catalog showing all types of mechanical, abrasive and diamond dressers and choose *exactly* the right tool to fit your needs.

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Special GRINDER for
CARBIDE TOOLS

Precision-built for accurately and quickly sharpening Carbide Tools. Sturdy ½ h.p. ball-bearing, reversible motor; 6" Silicon Carbide wheels and large adjustable tool-rest tables. **$95**

1 Year Guarantee

We also manufacture
GENERAL PURPOSE GRINDERS
ELECTRIC MOTORS
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BATTERY CHARGERS for Industrial and Automotive use. *Write for Bulletins.*

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In hard-to-get-at Places

Strand Flexible Shaft Machines find plenty of jobs to do in aircraft manufacture! Grinding, polishing, buffing, sanding, drilling, reaming, nut-setting . . . precision work on hard-to-reach surfaces of motor parts, tools and dies. For every job where an easily-controlled source of rotary power is needed, remember . . . **if you can reach it with your hand, you can reach it with a Strand Flexible Shaft.** Write for our suggestions for using Strand Flexible Shaft Machines to speed up your war production jobs.

DETAILS OF STRAND CONSTRUCTION

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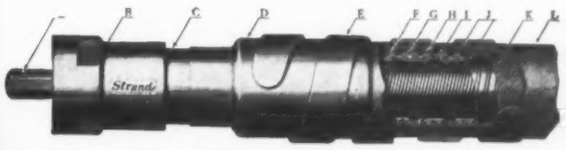

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FLEXIBLE SHAFTS

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Therein is the reason so many industrial firms fill all their gear requirements at Philadelphia. Constant checking and rechecking assures the accuracy that makes smooth, efficient, trouble-free operation a certainty. This same care is given all Philadelphia gears. Regardless of the type or size of gear you need, do as thousands of other plants have been doing during the past 50 years . . . specify Philadelphia. Why not get our gear catalog for handy reference? A request on your company letterhead brings a copy.

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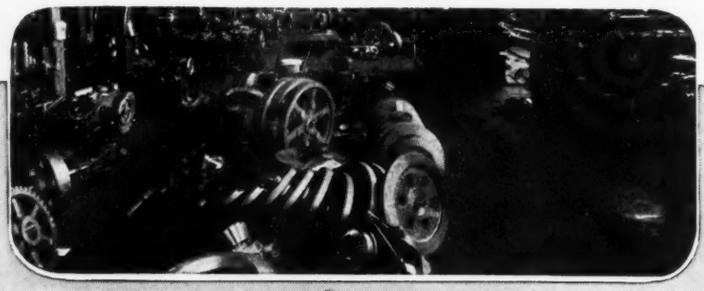

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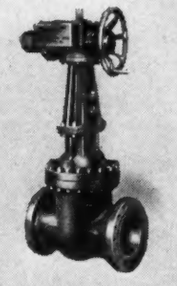
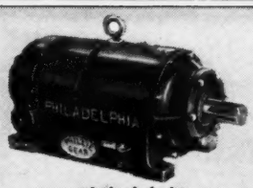


***Philadelphia* WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.



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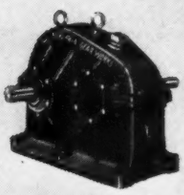

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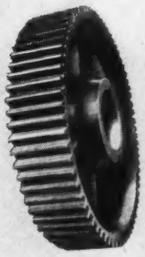

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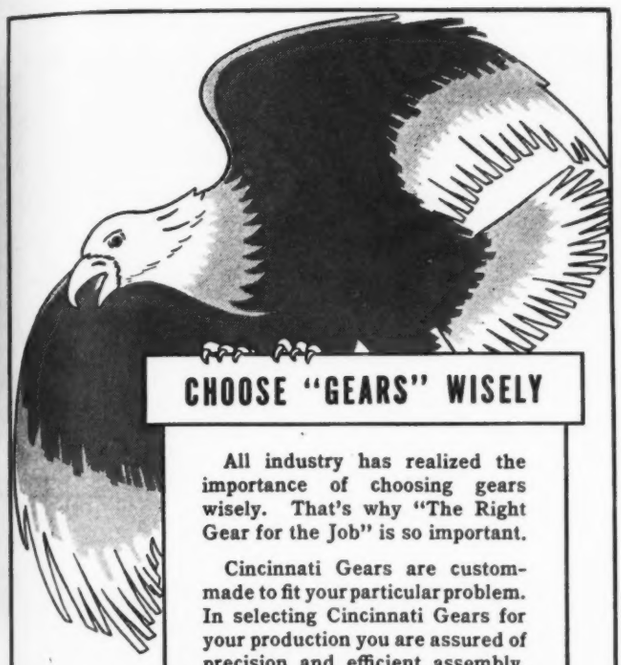

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All industry has realized the importance of choosing gears wisely. That's why "The Right Gear for the Job" is so important.

Cincinnati Gears are custom-made to fit your particular problem. In selecting Cincinnati Gears for your production you are assured of precision and efficient assembly.

Our gear counsel is used widely by many manufacturers. It may prove helpful to you.

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KEEP PRODUCTION UP!

Keep all your equipment operating with *war-winning* efficiency. Call Atlantic for rapid repair service, for prompt replacements, for good gears —QUICK! Write, phone or wire for quotations.

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ALL TYPES OF GEARS
Any Material
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Any Size

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Investigate Perkins facilities for producing the gears you need. You'll find that your most exacting requirements can be met, exactly to your specifications—from any material —in any quantity.

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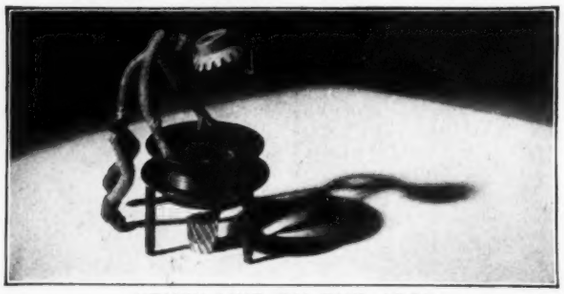
SEND US YOUR SPECIFICATIONS; ASK FOR QUOTATION

PERKINS
MACHINE & GEAR CO.
Springfield, Massachusetts

THEY MUST NOT FAIL

Instruments for defense require reliable gears.



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Mass Gears qualify on these essential parts.

Massachusetts Gear & Tool Company

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Gears

GEARS, GEARS, GEARS. Small ones or large • Stahl Gear has only one standard of quality • the best. We invite you to talk over your "big" gear problems with us. Many users could testify that Stahl is "geared" to serve you well. *TRY US.*

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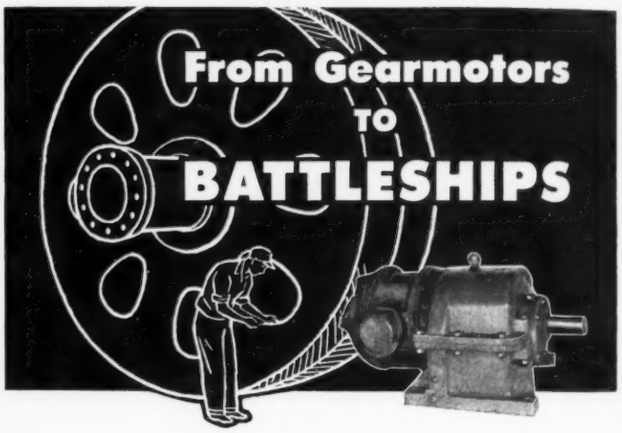
SPURS, SPIRALS, BEVELS, RACKS, WORMS • ANY SIZE • ANY QUANTITY



Westinghouse offers the solution to geared drive problems . . .

If you are faced with a drive problem, look to Westinghouse for the answer.

Westinghouse has the "know-how" that comes from over 50 years' experience in building every kind of geared drive . . . from gearmotors to giant propulsion gears for battleships. Ask your Westinghouse representative for recommendations.

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GEARED DRIVES

CUT GEARS

All Types and Sizes

Baldwin Roller Chain and Sprockets

Heat Treated Alloy Steel Gears to Customer's Specifications

Special Gears and Special Gear Units

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Spur Gears—½ in. to 30 ft. in dia. Racks curved
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Worm gears in any practical size
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ALL TYPES OF CUT GEARS

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The exact moment of the Zero Hour in Africa or the Far East will be unknown to us here on the home front. But in our plant, every hour is equally important in making doubly sure that the equipment for each man is expertly made — that it will stand up for the zero hours to come before Victory is won!

Diefendorf's job for the duration is gearing planes, tanks, guns—war equipment for the Zero Hour of America!

Diefendorf Gear Corp.
SYRACUSE, N. Y.

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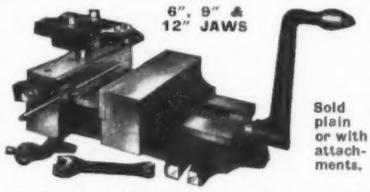
GRAHAM MULTI-PURPOSE VISE

Time is short — this vise saves it! By means of special attachments and jaws, it meets a vast variety of repeat-operation and special holding needs that would otherwise require jigs. As a plain vise, its flush, square and parallel accuracy make it ideal for general work on miller, drill press, radial, planer, shaper and grinder.



Sold plain or with attachments.

KNURL HOLDER FITTING LATHE TURRET

Using only a pair of straight-cut knurls, this tool can be adjusted to cut straight, spiral or checkered patterns of endless variety. Can pass over stock of larger diameter than knurled section. Shank made to fit your turret.

Illustrated price circulars upon request.

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SPUR — WORM — HELICAL — BEVEL

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GEARS — ALL MAKES . . . Special and Standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

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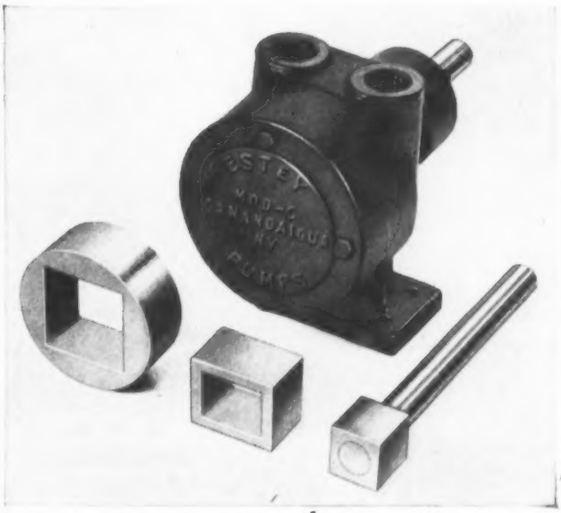
Represents three things to gear users—quality, speed, economy.

GRANT GEARS have a world-wide reputation. Accuracy, durability and dependability gained by experience of over sixty years.

GRANT GEAR WORKS, Boston, Mass.



ESTEY COOLANT PUMPS

Trouble-free! Durable! Estey Model C Coolant Pumps employ a unique but thoroughly practical design with only three moving parts. Capable of handling liquids of all viscosities, they will deliver 3 to 12 gallons per minute at 300 to 1200 R.P.M. Can be fully taken apart for cleaning without disturbing connections or mounting.

Quick Deliveries are possible! Write for full information.

FEATURES

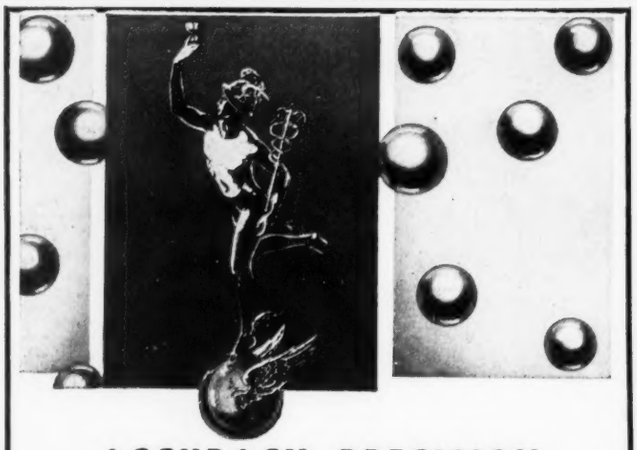
- S.A.E. Standard base mounting 2¼ x 4 inches.
- Ports tapped for ¾ inch pipe thread.
- Capacity 3 to 12 gals. per minute at three hundred to twelve hundred R.P.M.
- Only three moving parts—simple and rugged.
- Will pump coolants of all viscosities.
- Pumps may be taken apart without disturbing mounting or piping.

ESTEY PUMP CO., Inc., Canandaigua, N. Y.

Thor
STEEL STAMPS

Thor Stamps are made right. Characters are deeply cut, heads accurately turned and each stamp individually heat treated to the exact degree of toughness and hardness that gives the longest service — the most marks per dollar. Look for the name THOR and the BLUE HEAD on every stamp you buy.

THE PITTSBURGH STAMP COMPANY — **810 Canal St., Pittsburgh, Pa.**



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All WATERBURY STEEL BALLS are of uniform hardness which extends to the center of each ball. Made of high carbon chrome alloy steel highly finished.

WATERBURY STEEL BALLS

HIGH CARBON CHROME ALLOY STEEL, BRONZE, MONEL METAL, STAINLESS STEEL BALLS, STANDARD OR SPECIAL SIZES. WRITE FOR COMPLETE INFORMATION.

THE WATERBURY STEEL BALL CO., INC.
Poughkeepsie, New York
Factory: Waterbury, Conn.

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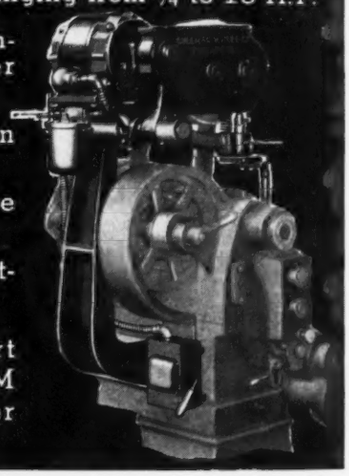
MOTOR DRIVES GET *Work Done* FASTER

STEP UP production 25%. Modernize your lathes, screw machines, shapers, punch presses, milling machines and similar equipment with CULLMAN Drives. Available for motors ranging from ¼ to 15 H.P.



Gives instant control and greater output.

Can be installed in a short time.

Affords belt-drive smoothness.

Permits better lighting.

The war effort needs MAXIMUM output. Write for the full facts.

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20 years without a drink—

"First bought 'Arguto' bearings 25 years ago . . . still buy them because they're alright."
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Wayne Junction, Philadelphia, Pa.

Heavy Duty Thrust Bearings

STANDARD SIZES or SPECIAL DESIGN to your specifications. Send sketch or sample for quotation—without obligation.

Any Quantity—One Bearing or Many. Catalog Upon Request.
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JUST 3 PARTS L-R FLEXIBLE COUPLINGS

BUT WHAT A SAVING TO VALUABLE MACHINERY!

L-R Type IA

L-R Type IA coupling CORRECTS MISALIGNMENT, absorbs shock, vibration, torque, intermittent overloads, saves space. Never needs lubrication. One of many L-R Types for all purposes. Send for complete Catalog.

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—and keeping 'em going has never been more important than it is today. Gits Oil Cups and Lubricating Devices, of every description, are answering the Call of the Colors with a proved-in-service reputation established thru more than 30 years of service to industry. Catalog No. 60, gives you 172 pages of answers to lubricating problems.

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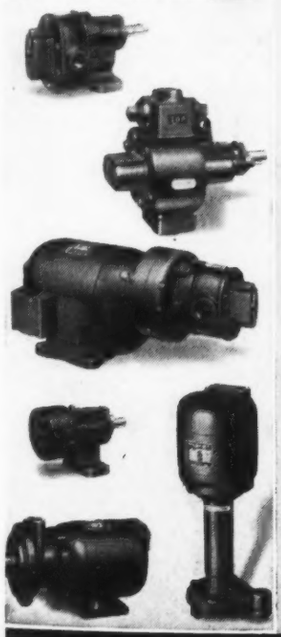
30 years of oil cup experience

LONG-LIVED
Brown & Sharpe Pumps



Geared, Vane and Centrifugal

Give *more* and *better* service, in today's accelerated production.

Ask for Catalog on the whole line--including Motor Driven Pumps

BROWN & SHARPE MFG. CO.
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B·S

BROWN & SHARPE PUMPS

HOLLOW SCREWS
"1-A" Selectees at the Draft-ing Board

FIRST TO COME UP when drafting a new machine: (1) how to save material; (2) how to reduce the size and weight of component parts. Hollow Screws help *materially.*

"First selectees" in Hollow Screws are the cold-drawn and *pressur-formd* ALLENS. Because these processes bring out the strongest attributes of hollow screws,—the ultimate in holding-power; the utmost strength for the *size* of screw.

Thirty-two years of hollow screw specializing are "inducted" in Allen's service *this* year—the time of supreme test. Thirty-two years of plant development are "peaked" to provide needed *millions* of "Allens" each week.

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

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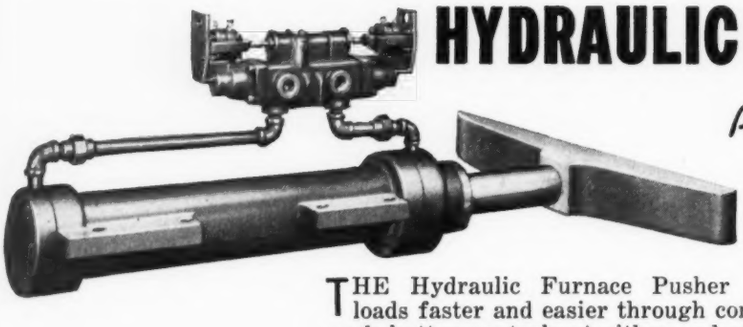
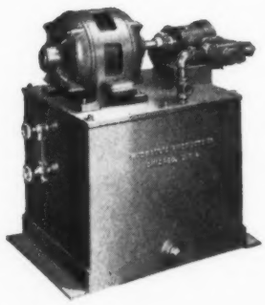
Better Results . . Easier Handling . . with the

HYDRAULIC FURNACE PUSHER

Proven by 5 Years Operation





THE Hydraulic Furnace Pusher handles furnace loads faster and easier through conveniently located push button controls at either end of the furnace.

Proven by 5 years operation in heavy forge work, without loss of production time and with very low maintenance costs.

Power for this pusher is furnished by the Hydraulic Pumping Unit shown at the right.

Write for Bulletin "P 3"

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HOW YOU CAN HELP TO SHORTEN THE WAR

Keep your pumps on the job . . . delivering at top capacity. For greater War production in 1942 will advance the date of Victory.

Write today for your free copy of the Viking Service Manual. It tells you how to get best performance out of Viking Rotary Pumps . . . explains and pictures correct installation . . . suggests how some repairs and replacements may be avoided.

PRIORITY RATINGS - - - - - Please!
Viking can supply pumps for War production work. It is **absolutely necessary** to give us your priority rating and allocation symbol. Be sure to obtain the highest rating possible. Priority regulations are changed frequently. Check up to see if changes made improve your rating. Thank you.

VIKING Pump COMPANY
CEDAR FALLS IOWA

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Eliminate lost time handling raw materials, castings, work in progress, finished parts. Lift and carry with Morgan Cranes everywhere in the shop. Write for details, sizes, prices.

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FOR SAFE—DEPENDABLE LUBRICATION

The safest and most economical way of eliminating guesswork — reducing motor burnouts—bearing failures—and oil waste. No need to "Shutdown" for oiling. Save time and worry.

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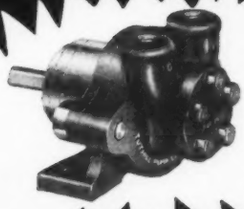

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TUTHILL SMALL PUMPS YOU CAN DEPEND ON FOR BIG JOBS

Typical of Tuthill's complete line of dependable small pumps is the Model L series. Hundreds of thousands of these positive displacement internal-gear rotary pumps prove their superiority in action. Ideal for coolant, lubrication, fuel oil transfer, hydraulic mechanisms and oil burners.

Model L pumps are available in capacities from .33 g.p.m. to 3 g.p.m. and pressures up to 400 p.s.i. Built with leakproof Tuthill mechanical seal.

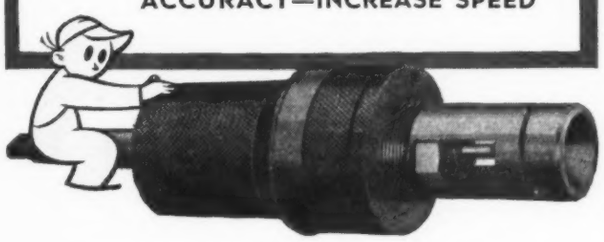
Model L pumps are obtainable for "ring" or "foot" mounting with various porting arrangements. Mounted on close-coupled motors, they require no base—save space, weight and labor.

Write for Tuthill Small Pump Catalog.

TUTHILL PUMP COMPANY

941 EAST 95th STREET • CHICAGO, ILLINOIS

UNIVERSAL CENTERING CHUCKS AND STANDARD CHUCKS STEP UP ACCURACY—INCREASE SPEED



Above: Universal Centering Chucks convert a drill press into a centering machine. Furnished with a set of bushings and collets for various size center drilling. Accurate and sturdy. Depth adjustment for centers. Write for facts.

Above: Universal Standard Collet Chucks hold tools in a grip as strong as solid steel itself. Nut for spanner wrench. The ideal tool for holding end mills, keyway cutters, drills, etc. Write for facts.

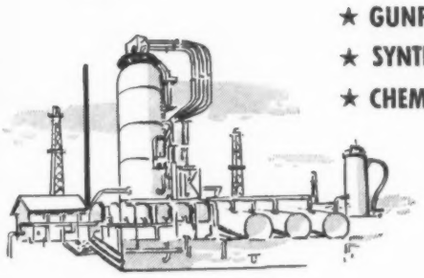
UNIVERSAL ENGINEERING CO.

FRANKENMUTH • MICHIGAN

WHY

Welded Stainless Tubing SPEEDS THE PRODUCTION OF

★ AVIATION GASOLINE
★ GUNPOWDER
★ SYNTHETIC RUBBER
★ CHEMICALS



Licking tough heat and corrosion problems is an everyday job where Carpenter Welded Stainless Tubing is helping to process these war-winning products. And the *uniform wall thickness* of this tubing lengthens the service life of vital processing equipment such as heat exchangers, condensers, catalyst holders and pipe lines. (There are no "thin spots" to give deterioration a foothold.) Carpenter Welded Stainless Tubing is given hydrostatic, tolerance, surface and straightness tests to insure chemical and physical perfection in each length.

WHY designers and fabricators adopt this WELDED tubing . . .

As tubing shapes are *natural design units,* parts can often be finish formed by merely bending, flanging, tapering or expanding. Then too, uniform tube walls permit the use of *lighter gauge* tubing — less metal — where strength and rigidity are needed. As this lighter gauge tubing is *ductile* and *easy to form,* it helps to reduce rejects . . . even in the hands of semi-skilled workers.

Carpenter Welded Stainless Tubing meets U. S. Army and Navy "specs," and is available in random lengths, and lengths cut to exact size.

Carpenter's Welded Stainless Tubing Data Book is a handy reference tool for engineers and executives who want more information on applying and fabricating this tubing. A note on your company letterhead will start a copy on its way to you.

THE CARPENTER STEEL COMPANY

Welded Alloy Tube Division, Kenilworth, N. J.

Carpenter WELDED STAINLESS TUBING

WANTED—A SALES MANAGER

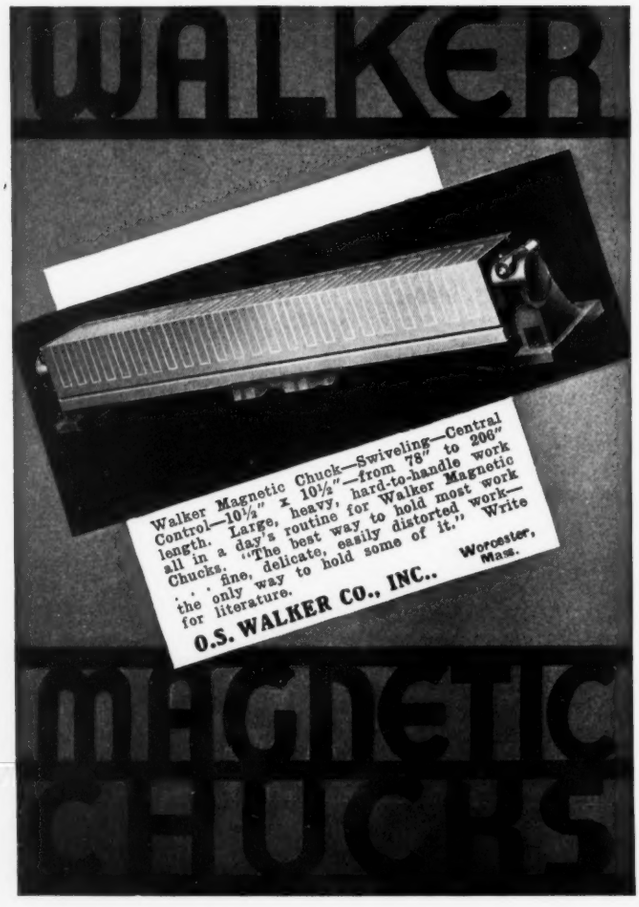
By A Leading Detroit Machine-Tool Builder

A permanent executive position—not a war job—with a medium-sized company, 45 years in the business. This company has earned a reputation for quality and world-wide recognition as a leader in its field.

Here are the requirements: Engineering knowledge and sound business judgment, plus experience and proven ability in the sale of specialized machine tools. The man for this important post has spent years in the development of a broad acquaintance in the machine-tool industry where he is well liked and respected. He is between 35 and 45 years of age, physically equipped to undertake the responsibility of directing an aggressive sales department consisting of an office staff and a group of salaried sales engineers in the field. He has a thorough knowledge of machining operations and methods, understands the application of standard and special machine tools, and possesses the personality to inspire confidence and develop business under a policy devoid of high-pressure sales methods.

If you have the training, experience and ability required for this position of leadership, write fully—giving complete personal data, including all positions held. State salary required. Your application will be regarded as confidential and none of your references will be contacted without your later approval. If your qualifications are satisfactory, an appointment will be made for a personal interview.

Address Box No. 861, In Care of This Paper


WALKER
Walker Magnetic Chuck—Swiveling—Central Control—10½" x 10½"—from 78" to 206" length. Large, heavy, hard-to-handle work all in a day's routine for Walker Magnetic Chucks. "The best way to hold most work . . . fine, delicate, easily distorted work—the only way to hold some of it." Write for literature.
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MAGNETIC CHUCKS

GAMMONS OF *Manchester*

PRODUCTION TOOLS

ORIGINATORS AND MANUFACTURERS OF HELICAL FLUTED TAPER PIN REAMERS

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Super-Sensitive Fixed-Center Multiple Drilling Heads
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All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

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HY-TEN

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"Magnafluxed" steels for aircraft and munitions applications; dependable, long lasting alloys for tool and die use; special steels for all kinds of specialized applications. Call our nearest warehouse for information and assistance in selecting steels to suit your most exacting needs.

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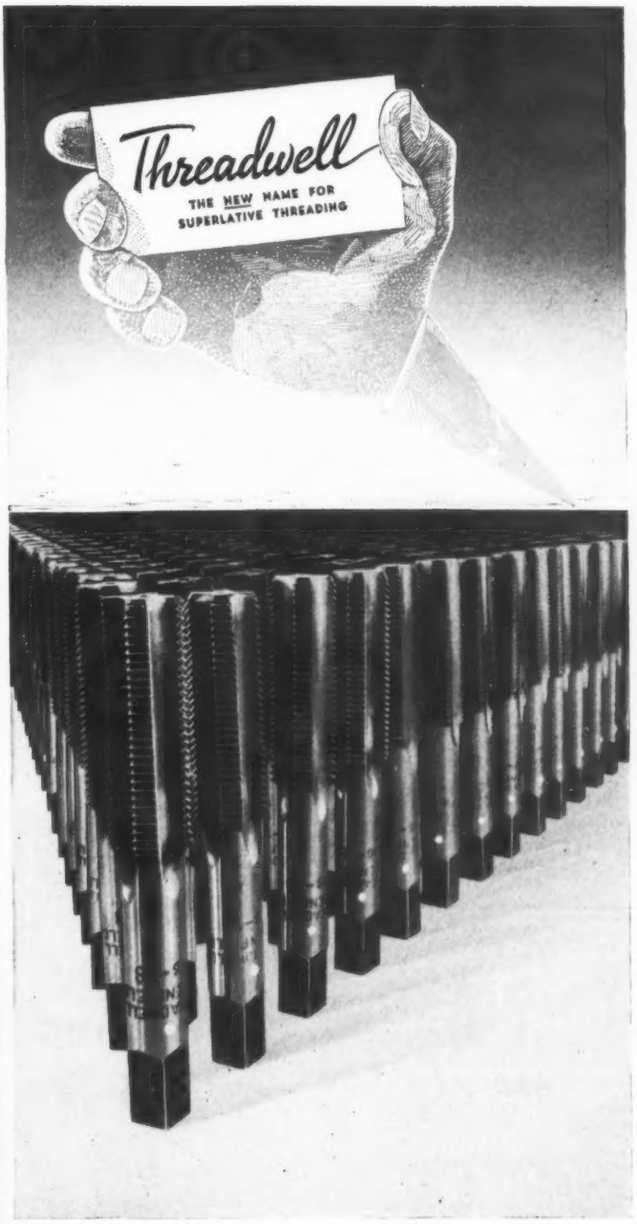

Tapping machine operators in key war industries everywhere are "discovering" in THREADWELL Taps the way to new records in threading performance. To them, this new name THREADWELL means ***results*** -- more holes per tap, and superlative quality. Have you tried THREADWELL?

WRITE FOR CATALOG ON YOUR FIRM LETTERHEAD.

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SALES AGENTS:
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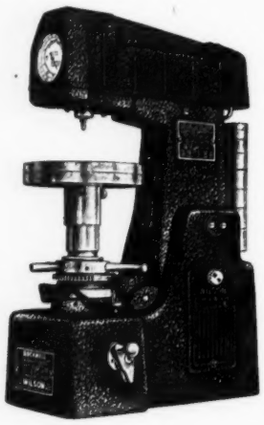
"ROCKWELL"
HARDNESS TESTER



When we put our Trade Mark—"ROCKWELL"—on a hardness tester, you are assured of its quality as to both precision and durability.

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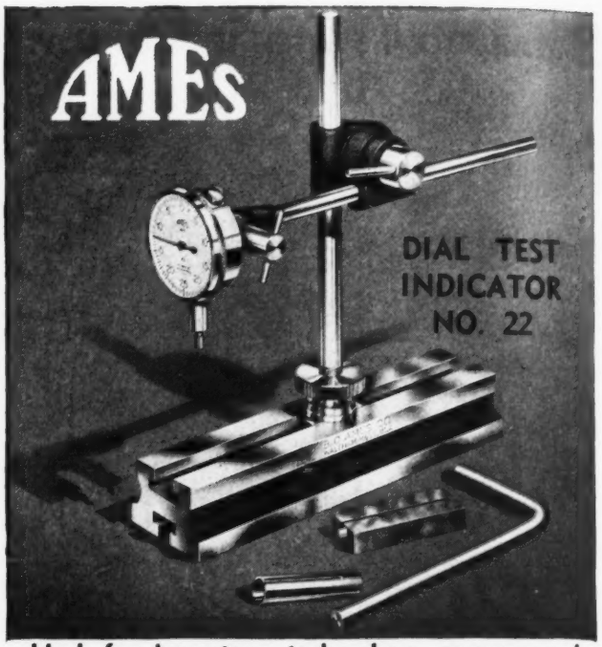
WILSON
MECHANICAL INSTRUMENT CO. INC.

AMEs



Ideal for inspectors, tool-makers, scrapers and assemblers to test in thousandths, half-thousandths or tenths of thousandths inches. Adjustable to all positions and used in tool holders of various machines. Priced at $30.

Send for bulletin

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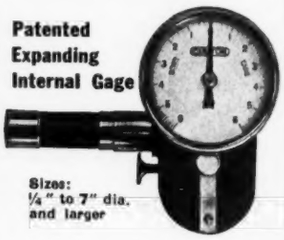
Airplane plants use COMTORPLUG —at the machines —for inspection

For gaging bores to fractions of .0001", use COMTORPLUG

Patented Expanding Internal Gage



Because of unique features, Comtorplug is used for a variety of inspections on airplane parts, such as wrist pin holes, propeller stud blind holes in crankshafts, articulated and master rod holes, ball and roller bearing housings, and many others. Also at the machines producing these bores, the automatic Comtorplug gives "inspector - accuracy" although the operators may not be trained gagers. ALL plants making precision bores should investigate this unusual gage!

Request Bulletin 27

THE COMTOR CO.
74 RUMFORD AVE.,
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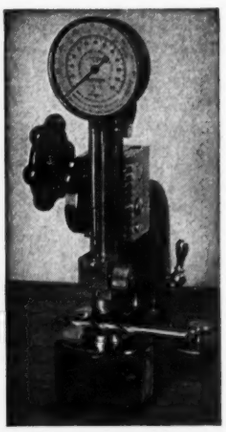

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Brinell — Shore — Scale

Included in our improved Portable Scleroscope Model D-1. This efficient single scale tester registers Brinell-Shore values without damage to the work. The old standby during the First World War is ready to serve again.

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TOOL CO., INC., Springfield, Vt., U.S.A.
POSITIVE LOCKING TYPE METAL CUTTING TOOLS FOR MILLING, BORING AND TURNING

FAVORITE*
Reversible Ratchet Wrench

By actual test, the FAVORITE Wrench tightens nuts 75% quicker than ordinary wrenches—and makes them tighter. Think what this means in speeding up your assemblies, and in saving time when connecting up or disconnecting pipe lines and apparatus.

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FAVORITES quickly save their cost by faster, better work. Three sizes of handles; each handle takes five different heads; each head fits two different size nuts. Write for circular and prices.

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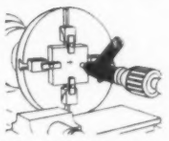
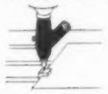
Like the Army's Rangefinder

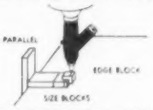
CENTER SCOPE



ON A LATHE—boring, turning or facing from a scribed layout—location accuracy .0001"—*Advantage*—TIME-SAVING!



ON A JIG BORER—ease of locating two edges as "zero points"—*Advantage*—UNFAILING ACCURACY and the ability to repeat set-up within .0001".



ON A VERTICAL MILL—locating and centering from an edge with size blocks—*Advantage*—JIG BORER ACCURACY on more machines.

ON A HORIZONTAL MILL—the ability to center a layout, edge block or rotary table plug while spindle is running. *Advantage*—QUICK AND EASY set-up for high precision work.

IS AN OPTICAL LOCATING AND CENTERING TOOL—THAT CAN BE USED ON ANY MACHINE!

The Army can't afford to miss—that's why it locates and centers its target by means of optics.

The CENTER SCOPE produces the same accuracy in the toolroom—where the cost of a "miss" is also measured in soldiers and material.

The CENTER SCOPE is a *shop tool*—a rugged yet accurate precision measuring instrument with 45x magnification. It's a time-saving, mistake-saving optical instrument that eliminates the human errors in tooling.

With the CENTER SCOPE you CAN *SEE THAT YOU ARE RIGHT!* You can locate edges or layouts to spindle axis 'within a tenth'—you can set-up faster and easier—you can compensate for spindle or adaptor run-out—and you have added confidence to go ahead with machining *at a faster rate!* You can't "miss" with a CENTER SCOPE. Write for complete information—NOW!

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FREE OPERATING MANUALS!
1. The CENTER-SCOPE and its Operation.
2. The CENTER-SCOPE and Optics.

AN EYE FOR ACCURACY

CLASSIFIED AND RE-SALE

Rates for Advertisements—$6.50 Column Inch Each Insertion

EASTERN OFFERS

RADIAL DRILLS

2½' Avey Sensitive
3' American Sensitive
3' Carlton Sensitive
4' Hammond Jack Knife
5½' Niles Semi-Universal, cone
No. 1 W. F. & John Barnes Horizontal

UPRIGHT DRILLS

10", 20", 22", 22½", 26", 28", 42" W. F. & John Barnes
22" Barnes All Geared Self-Oiling
22", 24" Aurora
24" Hoefer
24" Rockford
25" Superior
32" Cincinnati Bickford
32" Prentice

GEAR CUTTERS & HOBBERS

No. 5A Lees-Bradner Gear Generator
No. 12 Barber-Colman Gear Hobber
16" Gould & Eberhardt
18" Gleason Straight Tooth Bevel Gear Generator
18" Gleason Bevel Gear Planer
30" Brainerd Gear Cutter
Gleason Spiral Bevel Gear Rougher
No. 1—26" Whiton Full Universal Spur & Bevel
No. 3—26", 3—36", 3 Heavy, 4—36", 4—48", 6—60", 6—72" Brown & Sharpe Auto. Spur Gear Cutters
Cross Gear Tooth Rounder
No. 3—26" Cincinnati Gear Cutter

PLAIN CYLINDRICAL GRINDERS

10x18" No. 14 Brown & Sharpe
10x24" Landis, M.D.
10x30" Queen City, M.D.
10x36" Landis Integral Cam, M.D.
10x36" Norton, M.D.
10x50" Norton, M.D.
10x52" Landis, M.D.
10x72" Norton, M.D.
12x36" Cincinnati, belt
12x36" Cincinnati, M.D.
12x36" Modern, belt
12x36" Modern, M.D.
12x42" Landis, belt
12x48" Modern, M.D.
14x50" Norton, M.D.
18x72" Cincinnati Automotive Parts, M.D.

MILLING MACHINES

No. 1B Brown & Sharpe Plain, S.P.D.
No. 2B Milwaukee Plain Double Overarm
No. 2 Knight, S.P.D.
No. 1½ Cincinnati Plain, cone
No. 5 Becker Vertical
Gooley & Edlund Briggs Type
Pratt & Whitney Lincoln Type
6x14" Pratt & Whitney Thread
36"x36"x14's Bement Slab, M.D.
40" Ohio Tilted Rotary, M.D.

SHAPERS

20" Steptoe
24" Ohio
32" Morton Railroad Type Draw Cut, M.D.

TURRET LATHES AND SCREW MACHINES

No. 0 Brown & Sharpe Hand, cone
2¼x24" Jones & Lamson Geared Head, bar
3x36" Jones & Lamson, bar
3x36" Jones & Lamson, chucking (4)
2 spindle 3x36" Jones & Lamson, chucking (4)
Woods Tilted Turret, cone

AUTOMATICS

No. 33 New Britain, M.D.
⅜-½" Cleveland Model B, M.D.
⅞" Cleveland Model A
4 spindle ⅞" Cleveland Model M, M.D.
1¼" Cleveland Model C
1¼-1½" Cleveland Model B
No. 6D Potter & Johnston Automatic for brake drum work

PLANERS

48"x48"x10' Putnam, 3 heads

AIR COMPRESSORS

Usaco, M.D., 25 cu. ft.
6x6" Curtis Twin Cylinder
7x7" Curtis Twin Cylinder
Air Hoists

MANY OTHER MACHINES IN STOCK. SEND US YOUR INQUIRIES.

THE EASTERN MACHINERY CO.
1006 TENNESSEE AVENUE, CINCINNATI, OHIO

CIMSCO
Rebuilt Machine Tools

LATHES

21"x10' LeBlond, Cone
18"x8' American 3 S.C.D., D.B.G., Q.C.
18"x8' LeBlond 3 S.C.D., D.B.G., Q.C.
25"x16' LeBlond 3 S.C.D., D.B.G., Q.C.
42"x16' Niles Lathe, Cone Drive
48"x20' Fifield Lathe, Cone Drive
22"x13' Lehmann 16 spd. Grd. Hd., Q.C.
14"x6' Lodge & Shipley Q.C., 3 S.C.D., B.G.
20"x8' LeBlond Lathe, 3 S.C.D., Q.C.
14"x6' Hendey Grd. Hd. Lathe, S.P.D.
16"x8' Monarch Grd. Hd. Lathe, M.D.
18"x8' Walcott 3 S.C.D., D.B.G., Q.C.
36"x30' LeBlond Lathe, Cone Drive, Q.C.

RADIALS AND UPRIGHT DRILLS

4' Fosdick Plain Radial Drill, S.P.D.
6' Niles Universal Radial Drill, S.P.D.
26" Barnes Upright Drill Press, S.P.D.
28" Bickford Upright Drill Press

GEAR CUTTERS AND HOBBERS

Nos. 1 and 3 Adams Farwell Gear Hobbers
11" Gleason Bevel Gear Generator
No. 4—36" B & S Gear Cutter

SHAPERS AND PLANERS

16", 20" and 24" Gould & Eberhardt, High Duty
24" Queen City H.D. Crank, 4S, C.D.
24" Gould & Eberhardt, S.P.D.
24"x24"x6' Cincinnati Planer

MILLING MACHINES

No. 3 LeBlond Plain Miller, 3 S.C.D., D.B.G.
Hendey Lincoln Type Miller

GRINDERS

3' Pratt & Whitney Surf. Grinder

MISCELLANEOUS

1" Acme Bolt Cutter, Cone Drive
Quickwork Rotary Shear, M.D.
2" Landis Bolt Cutter, Double Spindle

If machines you need are not listed above, send us your inquiry. We have a very large stock.

Cincinnati Machinery & Supply Co.
217 E. Second St., Cincinnati, Ohio

EMERMAN RED BOOK
Machinery Tools and Supplies
HEADQUARTERS FOR ALL TYPES OF USED METAL WORKING MACHINERY— STAMPING PRESSES—STRUCTURAL TOOLS
LOUIS E. EMERMAN AND COMPANY
1761 ELSTON AVE. CHICAGO TEL. BRUNSWICK 4130
—Also FORGING EQUIPMENT—HYDRAULIC EQUIPMENT
—Our Stock is Large and Varied
—Our Prices Represent Real Values
SEND US YOUR INQUIRIES

LATE TYPE
GLEASON 37" BEVEL GEAR PLANER
Motor Drive
Other High Grade Machines Available
SEND US YOUR INQUIRY
MOREY MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

DESIGNERS OF JIGS, FIXTURES AND DIES
Prompt Service.
LAWRENCE W. SECREST CO.
P. O. Box 265, Alexandria, Virginia

MECHANICAL DESIGNERS WANTED
for design work on rifles and shotguns and on production equipment for same. Send complete outline of education and experience and salary wanted in first letter. Send also list of patents received, or other evidence of inventive ability. Permanent position for right man. Address Box 855, MACHINERY, 148 Lafayette St., New York.

DIE-CASTING

A complete treatise dealing with die-casting machines, the design of dies, and die-casting alloys. 300 pp., $3 per copy. Sent on approval.

MACHINERY, 148 Lafayette St., New York

FACE WHILE BORING

M-D Facing Head can be attached to Column Boring Mill Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically. 10 sizes, 6" to 46" dia. Write for descriptive bulletin and prices.

MUMMERT-DIXON COMPANY
HANOVER, PA.

CLASSIFIED AND RE-SALE SECTION

UNUSUAL TOOLS

Bending Brake, 4'x¼" Cincinnati Series 40-4
Bulldozer. No. 29 Williams & White, 16"x89" cross head
Borer. Excello 9 spindle radial
Drill. 22½" Barnes 4 spindle heavy duty
Drill. Foote Burt 3-way for multiple heads
Drill. No. 41 Natco in-line
Furnace. No. 1D American carburizing
Gear Quencher. 15" Gleason
Grinders. Nos. 50 and 60 Heald cylinder
Hammer. 500 lb. Bradley upright helve
Keyseater. 2½" No. 4 Mitts & Merrill
Miller, Thread. Hall Planetary
Miller. No. 3 Sundstrand Rigidmil
Nibbler. No. 1B Campbell 3/16"x24"
Punch. Cleveland, 1¼"x1", 26" throat horizontal
Rolls. 54" McKay sheet leveler
Wire Machines. ⅜"x3' and 5' Shuster

Mail us listing of Surplus tools
"Keep 'em flying"

MILES MACHINERY CO., Saginaw, Mich.

POSITIONS OPEN

Works Managers, Factory Managers, Superintendents, General Foremen, Shop Foremen, Production Managers, Purchasing Agents, Personnel Managers, Mechanical and Electrical Engineers, Chemists and Metallurgists, Designers and Draftsmen — send complete record of experience for immediate openings throughout country. Salaries $3000 to $20,000 year. Confidential. Established 27 years.

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NEED A REPRESENTATIVE IN CANADA?

Well-known Canadian engineering and manufacturing company is desirous of representing an American organization in Canada. Correspondence invited. Box No. 866, MACHINERY, 148 Lafayette St., New York.

WANTED — Practical Tool Room Foreman

Permanent connection with long established Newark Area concern now engaged in defense work, is offered to qualified man; must be fully conversant with operation of modern tool room, competent to lay out and supervise work; write full particulars first letter, including past connections and salaries. Box No. 865, MACHINERY, 148 Lafayette St., New York.

FOREMAN WANTED

Competent machine shop general foreman by plant located in industrial city in East Tennessee and doing general jobbing and building special machinery. Plant operates own foundry, machine shop, and patent shop. Offers splendid opportunity for rapid advancement. None but a man of highest qualifications need apply. Box 870, MACHINERY, 148 Lafayette St., New York.

If you are looking for a Superintendent, Foreman, Master Mechanic, etc., use this Classified Section. It will pay you.

SOMEWHERE THERE IS A DEFENSE PLANT URGENTLY IN NEED OF A

Factory Manager or Production Manager

1–Who knows how to get things done TODAY.
2–Who knows how to lead all types of men and get their co-operation.
3–Mechanical Engineer. Tool and machine designer.
4–Who would not ask any man to do quality and quantity on work which he can not do himself.
5–Who can with his own hands do any kind of work in a machine, or welding and fabricating shop, and therefore knows how to show others how.
6–Who in the past 35 years has had training and experience which very few men enjoy, because he knows what hard work and careful application is.
7–Who was a better than average machinist at 15.
8–Who can design war-winning special equipment, production lines, and machine tools.
9–Whose unbroken record for health and hard work helped our country win World War 1.
10–Who wants to change to a war production plant who will need him after the war, in which he can give to his country all of his training and experience to help lick those racketeers.

Please describe plant, product, proposition first letter. Box 868, care of MACHINERY, 148 Lafayette St., New York.

Die Maker Wanted

Die Maker that will qualify for Die Sinker of steel dies for War Production drop hammer tool products. Unusual opening for correct man with ability to eventually acquire position foreman of die department in plant of nationally known tool manufacturer to replace elderly man about to retire. Opportunity, steady position, good future. Address Box No. 864, care MACHINERY, 148 Lafayette St., New York.

FOR SALE

48"x32' Niles Heavy Duty Engine Lathe, 22'6" between centers. Plain change gear, screw cutting, double back geared. 30 HP, 3/220/60 reversing slip ring motor and gear unit mounted on lathe. 50 spindle speeds, 3 to 340 RPM. Complete tools and accessories. Now in daily operation. Excellent condition.

18" Sidney Engine Lathe, 32" bed, cone drive, D.B.G. quick change gears, taper attachment. Complete tools and accessories. Excellent condition.

Covington Electrical Mechanical Co.
BOWLING GREEN, KENTUCKY

MACHINERY WANTED

Long Bed Lathes up to 24"x24'.
State condition.

Box No. 867, care MACHINERY
148 Lafayette St., New York

TURRET LATHES
5D and 6D Potter & Johnston, M.D.
2¼"x24" Jones & Lamson
3"x36" Jones & Lamson
Goss & DeLeeuw, Model A, 6"x6¾"

MILLERS
No. 30 Sundstrand Rigidmill, M.D.
No. 3 Wigglesworth (New)
No. 2 Knight Vertical
2" Pratt & Whitney Duplex Spline

GEAR MACHINERY
No. 4—48" Brown & Sharpe Gear Cutter
9" Pratt & Whitney Gear Grinder
Cimatool Gear Chamfering Machine, M.D.

LATHES
14"x6' Whitcomb 16"x8' Flather

GRINDERS
No. 20 Heald Surface, M.D.
No. 72-A-3 Heald Internal, M.D.
No. 6 Bryant Internal, M.D.
No. 16A Blanchard, M.D.
9" Pratt & Whitney Gear, M.D.

DRILLS
3' Morris Enc. Head, M.D.
4-spindle Taylor & Fenn, M.D. (2)
B-16 Natco Multiple, M.D.
B-13 Natco Multiple, M.D.

MISCELLANEOUS
8" Bullard Multimatic, M.D.
24"x24"x6' Whitcomb Planer
No. 303 Bliss Straight Side Press
No. 20 Waterbury-Farrel Thread Roller
No. 1 Foote-Burt Duplex Surface Broach
500 lb. Bradley Hammer
No. 4 Hilles & Jones Double Punch Shear
No. 21 S.A. Cochrane Bly Hi Speed Saw

WIGGLESWORTH MACHINERY COMPANY
198 Bent St., Cambridge, Mass.

WAR CONTRACTORS

Use your plant facilities to the utmost by improved material and product handling methods. Consult SEDGWICK for engineering advice on elevators, dumb-waiters and hoists to solve vertical transportation problems.

Sedgwick Machine Works
167 W. 15th St., New York, N. Y.

Manufacturing Executive:

One of the best informed and most widely experienced men in the mechanical field today seeks to serve his country in defense work. He did this during the World War as a kid.

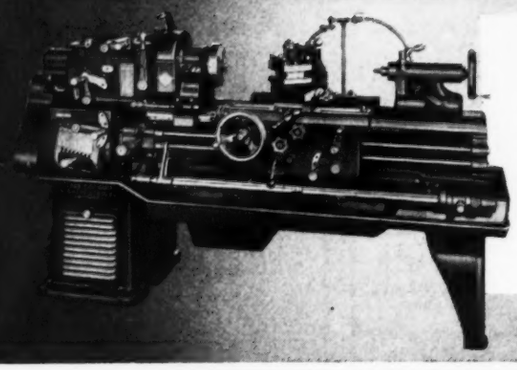
Mechanical Engineer. Industrial Engineer trained by the Father of Efficiency. Tool and Machine Designer, Superintendent, Works Manager, Writer, Lecturer. Has never been unemployed. Do you need a human Dynamo who is able to LEAD and inspire men to greater efforts; who knows the HOW on every machine operation, and the WHY on the assembly line; who has the will and the physical fitness to work 15 hours per day; who is aching to help lick those monsters who destroy our liberty.

Box No. 869, care of MACHINERY
148 Lafayette St., New York.

Can You Build Machinery?

Prominent manufacturer of large machinery wants to subcontract units weighing from 5 to 10, or 20 tons. If you have accurate turning equipment (14-24"), planing equipment (48" or larger), horizontal boring machines, plain cylindrical grinders, etc., as well as experienced fitting and assembling gang, write Box No. 862, MACHINERY, 148 Lafayette St., New York, N. Y.

CINCINNATI LATHES

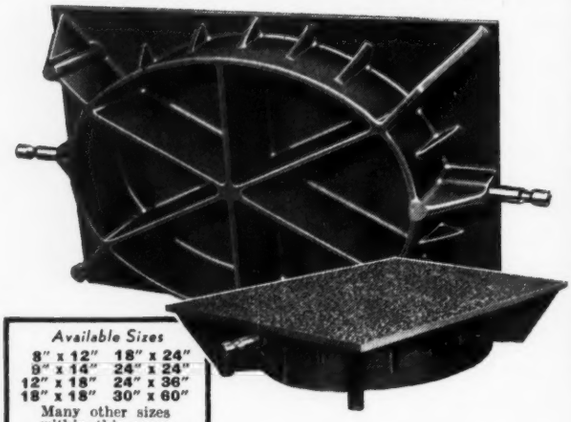


SPEED MASS-PRODUCTION OF AIRCRAFT AND MUNITIONS

In continuous operation on precision jobs, Cincinnati Lathes are speeding vital war production. Their wide range of feeds and speeds, plus the extra heavy construction of bed and ways, permit efficient operation on any job in any material. Write for latest catalog giving details of 14" to 30" sizes.

THE CINCINNATI LATHE AND TOOL CO.
Disney Drive, Oakley, Cincinnati, Ohio
SPECIALISTS SINCE 1906

Smith Master Plates
are DIFFERENT

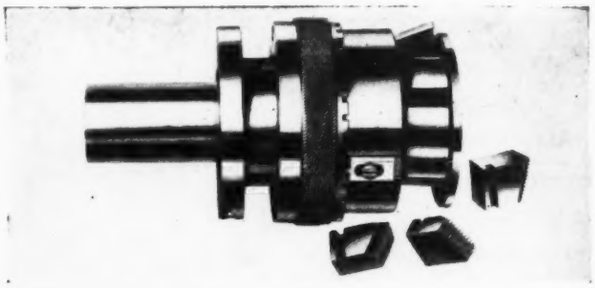


Available Sizes	
8" x 12"	18" x 24"
9" x 14"	24" x 24"
12" x 18"	24" x 36"
18" x 18"	30" x 60"

Many other sizes within this range

If you want to really get the maximum freedom from distortion -- if you want to minimize deflection -- if you want an original design which insures ample rigidity and stiffness for accurate measuring -- if you want a surface plate which is truly a Master Plate, you will want to learn all about the Smith Master Surface Plates. Exclusive in design, these plates are filling surface plate requirements with amazing satisfaction. Write for detailed information and descriptive literature today!

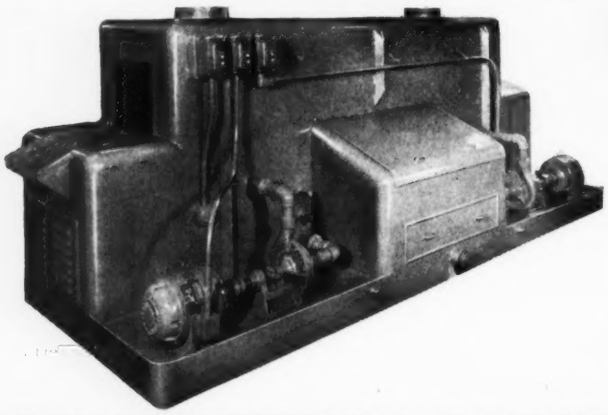
SMITH TOOL WORKS, INC., BUCYRUS, OHIO



RICKERT SHAFER *Specialists* IN THREADING TOOLS

- AUTOMATIC DIE HEADS
- COLLAPSIBLE TAPS
- BORING HEADS
- FRICTION TAPPERS
- SPECIAL THREADING MACHINES

The RICKERT-SHAFER Co.
ERIE, PA.



HOWARD

Conveyor Wash and Rinse Machine

The HOWARD line of industrial cleaning and finishing machines is designed and built for long-term, trouble-free operation, for continuous and dependable contributions to high-speed production. Model illustrated features drive motor, V-belt drive, reducer, chain drive and link-type, unloading belt. Bulletin illustrates various models popular in war production. Write for your copy.

Specialists in Rotary Washers, Conveyor Washers, Monorail Washers, Cabinet Washers, Strip Washers, Small Parts Washers, Sawdust Driers, Hot Air Driers, Chip Separators, Tumbling Mills, Burnishing Barrels, Pickling Machines, Oil Quenchers.

HOWARD ENGINEERING & MANUFACTURING CO., 1058 Hulbert, Cincinnati, Ohio

UNIVERSAL BUSHINGS
WORK FOR UNCLE SAM
Drill Bushings are a small but important cog in the precision manufacture of war equipment being built today for Uncle Sam. Because of their straight and round super-finished bores Universal Bushings assure accuracy and unexcelled wearing qualities. Write for facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

MADISON BORING BARS

Less Wear! Less Time Out!

Madison Boring Bars are accurate to .00025" and their floating cutter construction insures accurate alignment—and less wear. The result—less time out for regrinding and *more work per tool.* Write for bulletin.

MADISON
Manufacturing Co.
Muskegon, Mich.

NAME PLATES

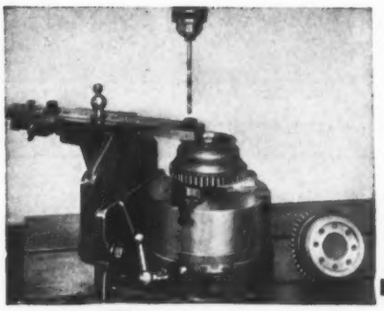
Etched on thin metal . . . 36 to 48 hour service . . . Write for samples and prices

HORAN · 44 W. 28 ST., NEW YORK CITY

Hollow Bored Forgings
Lathe and Milling Machine Spindles
Hydraulic Cylinders

Let us have your inquiries on any requirements of Hollow Bored Forgings and Steel Shafts.

AMERICAN HOLLOW BORING COMPANY
1041 WEST 19th STREET, ERIE, PENNA.



Shown equipped with a drilling attachment, the Super-Spacer is producing accurately spaced holes in an aircraft gear.

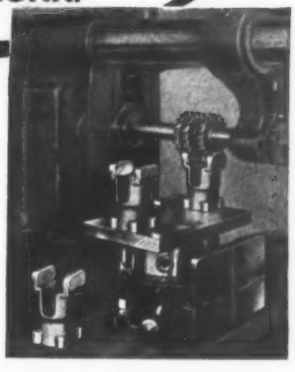
THE HARTFORD SUPER-SPACER

FOR RAPID, ACCURATE CHUCKING AND INDEXING

Accurate enough for aircraft work! Rigid enough for milling, slotting and planing jobs! Use the Hartford Super-Spacer to obtain divisions of 2, 3, 4, 6, 8, 12 or 24. Interchangeable mask plates make operations rapid and fool-proof, eliminating counting off. In addition, graduations in degrees on circumference permit odd spacings to be made. The Super-Spacer may be mounted on any machine table, either horizontally or vertically. In either position it is more rigid than the conventional dividing head.

Use the Super-Spacer to speed up both small lot and long run operations. It will save many a jig and fixture and insure high production of unfailing accuracy.

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.



Milling jobs like this prove the Super-Spacer's rigidity and accuracy. Set up to index 180°, one part is loaded while the other part is being milled.

PRODUCT INDEX

For location of advertisements of manufacturers listed, see alphabetical index, pages 349-350

ABRASIVE CLOTH AND PAPER
Carborundum Co., Niagara Falls, N. Y.
Walls Sales Corp., 96 Warren St., New York.

ABRASIVE DISCS
deSanno, A. P., & Son, Inc., Phoenixville, Pa.

ABRASIVES, POLISHING
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ACCUMULATORS, HYDRAULIC
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Co., Ltd., York, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.

AIR CONDITIONING EQUIPMENT
York Ice Machinery Corp., York, Pa.

AIR HOISTS
See Hoists, Air.

AIR TOOLS
See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

IT'S MADE OUT OF
SPEED CASE STEEL
A LOW CARBON OPEN HEARTH PRODUCT

—because . . .

It increased production 56%
It saved $70.89 per ton of steel used
It carburized without soft spots
It had strength equal to X 1020

Ductility Plus Machinability (230 SFPM)

In this "all-out" war effort Monarch Steel is co-operating 100%. We're helping to "keep 'em rolling" with Speed Case Steel.

Licensee for Eastern States
THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO

Licensor
MONARCH STEEL COMPANY
HAMMOND • INDIANAPOLIS • CHICAGO
PECKOVER'S LTD., Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

ALLOY-STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disc Div.-Borg-Warner Corp., New Castle, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY, STEEL, TUNGSTEN, VANADIUM, MANGANESE
Republic Steel Corp., Cleveland, O.

ALLOYS, ZINC
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland.
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Davis Boring Tool Div., St. Louis, Mo.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jacobs Mfg. Co., Hartford, Conn.
Kempsmith Mch. Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

BABBITT
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

BALANCING EQUIPMENT
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Sundstrand Mch. Tool Co., Rockford, Ill.

BALLS, BRASS, STEEL, ETC.
Gwilliam Co., Brooklyn, N. Y.
S K F Industries, Inc., Philadelphia.
Waterbury Steel Ball Co., Inc., Poughkeepsie, N. Y.

BARS, BORING
See Boring Bars.

BARS, PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Phosphor Bronze Smelting Co., Philadelphia.

BARS, STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Jessop Steel Co., Washington, Pa.
LaSalle Steel Co., P. O. Box 6800 A., Chicago.
Monarch Steel Co., Indianapolis, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Div., Massillon, O.
Wheelock, Lovejoy & Co., Cambridge, Mass.

BASES, MACHINERY, WELDED
Mahon, R. C., Co., Detroit, Mich.

BEARINGS, BABBITT
Bunting Brass & Bronze Co., Toledo, O.
Hill Acme Co., Cleveland, O.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, BALL
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Inc., Poughkeepsie, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Marlin-Rockwell Corp., Jamestown, N. Y.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
S K F Industries, Inc., Philadelphia.
Torrington Co., Torrington, Conn.

BEARINGS, BRONZE AND SPECIAL ALLOY
Ampco Metal, Inc., Milwaukee, Wis.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.

Bunting Brass & Bronze Co., Toledo, O.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, LINESHAFT
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland, O.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Roller Bearing Co. of America, Trenton, N. J.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, NEEDLE
Bantam Bearings Corp., South Bend, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, ROLLER
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia.
Timken Roller Bearing Co., Canton, O.

BEARINGS, SELF-LUBRICATING (OILLESS)
Arguto Oilless Bearing Co., Wayne Jct., Philadelphia.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

BEARINGS, TAPERED ROLLER
Bantam Bearings Corp., South Bend, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Timken Roller Bearing Co., Canton, O.

BEARINGS, THRUST
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hill Acme Co., Cleveland, O.
Marlin-Rockwell Corp., Jamestown, N. Y.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
S K F Industries, Inc., Philadelphia.
Timken Roller Bearing Co., Canton, O.

BELT FASTENERS, METAL, LEATHER, ETC.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

BELT SHIFTERS
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Ready Tool Co., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION
Houghton, E. F., & Co., Philadelphia, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.

BENCHES, WORK, AND BENCH LEGS
Baumbach, E. A., Mfg. Co., 810 S. Kilbourn Ave., Chicago.
Hill Acme Co., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, ANGLE IRON
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

BENDING MACHINES, HYDRAULIC
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.

BENDING MACHINES, PIPE
Farquhar, A. B., Co., Ltd., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Watson-Stillman Co., Roselle, N. J.

BLAST CLEANING EQUIPMENT
American Foundry Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Production Machine Co., Greenfield, Mass.
Walls Sales Corp., 96 Warren St., New York.

BLOCKS, CHAIN—See Hoists, etc.

BLOWERS
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BLUEPRINT MACHINERY AND ACCESSORIES
Paragon-Revolute Corp., Rochester, N. Y.
Pease, C. F., Co., 2622 W. Irving Park Rd., Chicago

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

BOLT AND NUT MACHINERY
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Denison Engineering Co., Columbus, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Oster Manufacturing Co., Cleveland, O.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
National Acme Co., Cleveland.

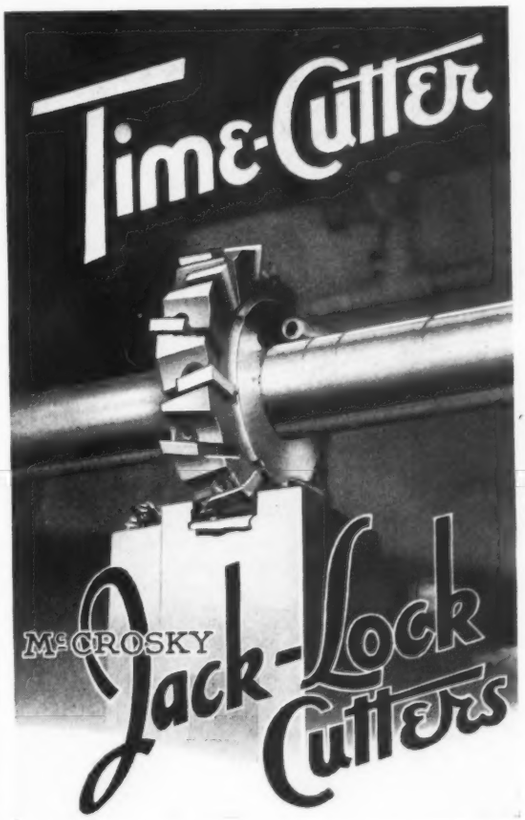
BOOKS, TECHNICAL
Industrial Press, 148 Lafayette St., New York.
Lincoln Electric Co., Cleveland, O.

BORING AND DRILLING MACHINES, VERTICAL
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John Co., Rockford, Ill.
Bullard Company, Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland.
Gorton, George, Mch. Co., Racine, Wis.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland.
Sellers, Wm., & Co., Inc., Philadelphia.

BORING AND TURNING MILLS, VERTICAL
Bullard Company, Bridgeport, Conn.
Cincinnati Planer Co., Cincinnati.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Rogers Machine Works, Inc., Alfred, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia.

BORING BARS
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Inc., Detroit.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.
McCrosky Tool Corp., Meadville, Pa.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

BORING, DRILLING AND MILLING MACHINES, HORIZONTAL
Barnes, W. F., & John, Co., Rockford, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.



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BORING HEADS

Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Gairing Tool Co., Detroit.
McCrosky Tool Corp., Meadville, Pa.

BORING HEADS, OFFSET

Gairing Tool Co., Detroit.
Rickert-Shafer Co., Erie, Pa.

BORING MACHINES, DIAMOND AND CARBIDE TOOL

Ex-Cell-O Corporation, Detroit.
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Stokerunit Corp., Milwaukee, Wis.

BORING MACHINES, JIG

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Fosdick Machine Tool Co., Cincinnati, O.
Machinery Mfg. Co., Los Angeles, Calif.
Reed-Prentice Corp., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.

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Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Carboloy Co., Inc., Detroit.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Mch. Co., Madison, Wis.
Haynes Stellite Co., Kokomo, Ind.
Jones & Lamson Mch. Co., Springfield, Vt.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., No. Chicago, Ill.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland.
Lapointe Machine Tool Co., Hudson, Mass.
National Broach & Mch. Co., Detroit, Mich.

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Bunting Brass & Bronze Co., Toledo, Pa.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Jefferson Machine Tool Co., Cincinnati, O.
Johnson Bronze Co., New Castle, Pa.
Phosphor Bronze Smelting Co., Philadelphia.

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Black & Decker Mfg. Co., Towson, Md. (Portable Electric).
Delta Mfg. Co., Milwaukee, Wis.
Gardner Mfg. Co., Beloit, Wis.
Production Machine Co., Greenfield, Mass.
Rotor Tool Co., Cleveland, O.
United States Electrical Tool Co., Cincinnati.

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Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.

BURNISHING MACHINERY

Baird Machine Co., Bridgeport, Conn.

BUSHINGS, BRASS, BRONZE, ETC.

Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.

BUSHINGS, HARDENED

Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Leland-Gifford Co., Worcester, Mass.
U. S. Tool Company, Inc., Ampere, N. J.

BUSHINGS, JIG

Ampco Metal, Inc., Milwaukee, Wis.
Ex-Cell-O Corporation, Detroit.
Universal Engineering Co., Frankenmuth, Mich.

CABINETS, TOOL

Armstrong Brothers Tool Co., 313 No. Francisco Ave., Chicago.

CALIPERS

Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

CAM CUTTING MACHINES

Frew Machine Co., Philadelphia.
Pratt & Whitney Co., West Hartford, Conn.

CAM MILLING AND GRINDING MACHINES

Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence (Screw Machines).
Hartford Special Mchry. Co., Hartford, Conn.
Kux Machine Co., 3930-44 W. Harrison St., Chicago.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDE, TANTALUM, TITANIUM AND TUNGSTEN

Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Vanadium Alloys Steel Co., Latrobe, Pa.
Vascoloy-Ramet Corp., No. Chicago, Ill.

CASE-HARDENING

Pittsburgh Gear & Machine Co., Pittsburgh, Pa.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

CASE-HARDENING FURNACES

See Furnaces, Heat Treating.

CASTINGS, BRASS, BRONZE AND ALUMINUM

Ampco Metal, Inc., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa. (Brass & Bronze only).
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Jefferson Machine Tool Co., Cincinnati, O.

CASTINGS, DIE

Madison-Kipp Corporation, Madison, Wis.

CASTINGS, GRAY IRON

Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence.
Covel Mfg. Co., Benton Harbor, Mich.

CASTINGS, STEEL, ALLOY, ETC.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

CEMENT, DISC GRINDING WHEEL

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Gardner Machine Co., Beloit, Wis.
Walls Sales Corp., 96 Warren St., New York.

CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.
Sundstrand Mch. Tool Co., Rockford, Ill.

CENTERS, LATHE
Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Modern Machine Corp., Brooklyn, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Vascoloy-Ramet Corp., No. Chicago, Ill.

CENTERS, PLANER AND MILLER
Cincinnati Planer Co., Cincinnati.

CHAIN BLOCKS
See Hoists, Chain, etc.

CHAIN DRIVES
Morse Chain Co., Ithaca, N. Y.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHAINS, POWER TRANSMISSION AND CONVEYOR
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHAMFERING MACHINES, GEAR TOOTH
Bilgram Gear & Mch. Works, Philadelphia.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit, Mich.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Lipe-Rollway Corporation, Syracuse, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

CHIP WRINGERS
Tolhurst Centrifugal Div., American Machine & Metals, Inc., East Moline, Ill.

CHISELS AND CHISEL BLANKS, PNEUMATIC HAMMER
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.

CHUCKING MACHINES
Bardons & Oliver, Inc., Cleveland, O.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bullard Company, Bridgeport, Conn.
Cleveland Automatic Machine Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Goss & De Leeuw Mch. Co., New Britain, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
National Acme Co., Cleveland.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mch. Tool Co., Rockford, Ill.
Warner & Swasey Co., Cleveland.

CHUCKING MACHINES, MULTIPLE SPINDLE
Goss & De Leeuw Mch. Co., New Britain, Conn.
National Acme Co., Cleveland.

CHUCKS, AIR-OPERATED
Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

CHUCKS, COLLET OR SPLIT
See Collets.

CHUCKS, DIAPHRAGM
Van Norman Mch. Tool Co., Springfield, Mass.

CHUCKS, DRILL
Cleveland Twist Drill Co., Cleveland.
Ettco Tool Co., Brooklyn, N. Y.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.

CHUCKS, FULL FLOATING
Errington Mechanical Laboratory, 200 Broadway, New York.
Gisholt Mch. Co., Madison, Wis.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.

CHUCKS, LATHES, ETC.
Bullard Company, Bridgeport, Conn.
Cushman Chuck Co., Hartford, Conn.
Gisholt Mch. Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Warner & Swasey Co., Cleveland.

CHUCKS, MAGNETIC
Arter Grinding Machine Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, QUICK CHANGE AND SAFETY
Errington Mechanical Laboratory, 200 Broadway, New York.
Jarvis, Chas. L., Co., Middletown, Ct.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.

CHUCKS, RING WHEEL
Gardner Machine Co., Beloit, Wis.

CHUCKS, TAPPING
Barber-Colman Co., Rockford Ill.
Errington Mechanical Laboratory, 200 Broadway, New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.

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Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Danly Mch. Specialties, Inc., 2112 So. 52nd Ave. Chicago.
Starrett, L. S., Co., Athol, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York.

CLEANERS, CHEMICAL, FOR METAL
Bullard Co., Bullard-Dunn Process Div., Bridgeport, Conn.
Magnus Chemical Co., Garwood, N. J.
Oakite Products Inc., 26 Thames St., New York.

CLUTCHES
Barnes Drill Co., Rockford, Ill.
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Lipe-Rollway Corporation, Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Rockford Drilling Mch. Div., Rockford, Ill.
Twin Disc Clutch Co., Racine, Wis.

COATINGS, PROTECTIVE
Bakelite Corp., 30 E. 42nd St., New York.
Bullard Co., Bullard-Dunn Process Div., Bridgeport, Conn.

COLLARS, SAFETY
Hill Acme Co., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLARS, SPACING, ETC.
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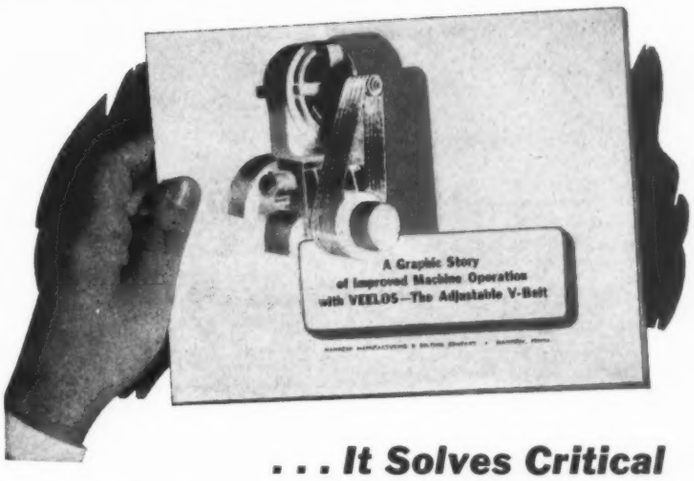

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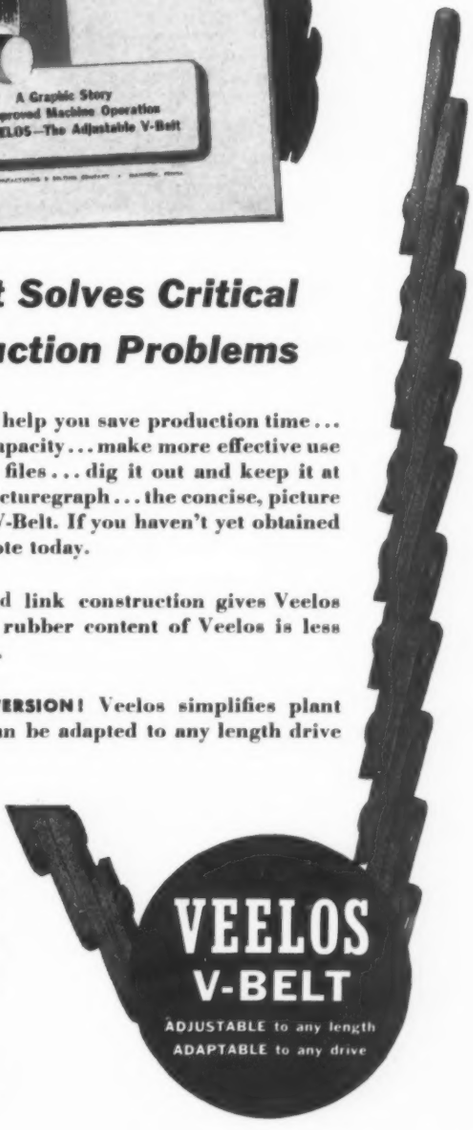

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Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Wks., Rochester, N. Y.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland.

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Jones & Lamson Mch. Co., Springfield, Vt.

COMPOUNDS, CLEANING
Houghton, E. F., & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.

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Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Magnus Chemical Co., Garwood, N. J.
National Broach & Mch. Co., Detroit, Mich. (Broaching and Lapping).
Oakite Products, Inc., 26 Thames St., New York.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 East 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

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General Electric Co., Schenectady, N. Y.

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Columbus Die, Tool & Mch. Co., Columbus, O.
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Ex-Cell-O Corp., Detroit.
Hartford Special Mchry. Co., Hartford, Conn.
Hill Acme Co., Cleveland, O.
Jefferson Machine Tool Co., Cincinnati, Ohio.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lees-Bradner Co., Cleveland.
Modern Mch. Corp., 323 Berry St., Brooklyn, N. Y.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., Cleveland.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Taylor-Shantz, Inc., Rochester, N. Y.
U. S. Tool Company, Inc., Ampere, N. J.

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Mathews Conveyer Co., Ellwood City, Pa.

CONTROLLERS
Allen-Bradley Co., Milwaukee, Wis.
Clark Controller Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.

COUNTERBORES
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Haynes Stellite Co., Kokomo, Ind.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Starrett, L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., North Chicago, Ill.

COUNTERSHAFTS
Hill Acme Co., Cleveland, O.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Standard Pressed Steel Co., Jenkintown, Pa.
Warner & Swasey Co., Cleveland.

COUNTERSINKS
Ex-Cell-O Corporation, Detroit.
Gairing Tool Co., Detroit.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

COUNTERS, REVOLUTION
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, L. S., Co., Athol, Mass.

COUPLINGS, FLEXIBLE
Atlantic Gear Works, Inc., 200 Lafayette St., New York.
Baldor Electric Co., St. Louis, Mo.
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

COUPLINGS, SHAFT
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Sellers, Wm., & Co., Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, ELECTRIC TRAVELING
Morgan Engineering Co., Alliance, O.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANES, HAND TRAVELING
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

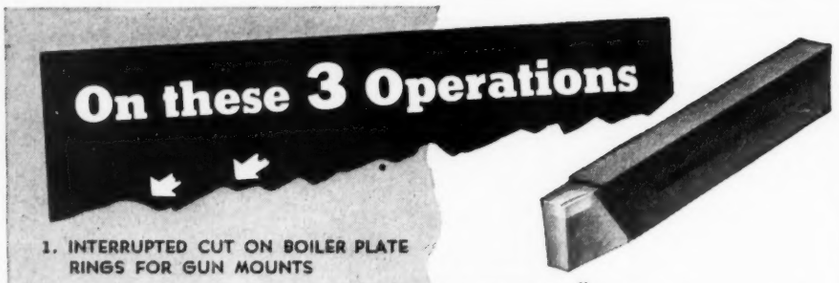
CRANES, LOCOMOTIVE
Cullen-Friestedt Co., 1305 S. Kilbourn Ave., Chicago.

CRANES, PORTABLE
Hill Acme Co., Cleveland, O.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, etc.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence.
Ex-Cell-O Corporation, Detroit.
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago. (Gear Shaper).
Michigan Tool Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Broach & Mch. Co., Detroit, Mich. (Gear Shaper).
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Waltham, Mass.

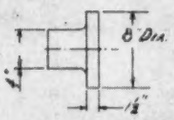
CUTTERS, MILLING
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Carboloy Co., Inc., Detroit.
Columbus Die, Tool & Machine Co., Columbus, O.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gammons-Hoaglund Co., Manchester, Conn.
Gorton, George, Mch. Co., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Kearney & Trecker Corp., Milwaukee, Wis.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit, Mich.



1. INTERRUPTED CUT ON BOILER PLATE RINGS FOR GUN MOUNTS

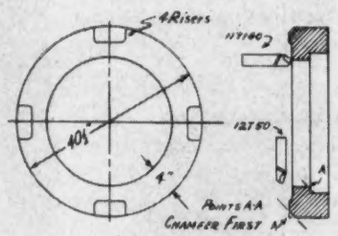
Material: Flame Cut Boiler Plate
Speed: 14 RPM; 190 ft./min.
Roughing: Feed 1/32"—Depth 3/16"
Finishing: Same Speed and Feed

2. ROUGHING AND FINISHING 8" DIAMETER GEAR BLANKS



Material: Rough Forgings SAE 1045
Speed: 165 RPM; 340 ft./min.
Turning O. D.: Feed .010"—Depth 1/8"
Facing: Feed .005"—Depth 1/8"

3. FACING AND BORING ALUMINUM RING CASTING



Material: Aluminum Bronze Casting
Speed: 19 RPM; 200 ft./min.
Facing: Depth 5/16"
Boring: Feed .011"—Depth 3/8"

KENNAMETAL* Performed Successfully AFTER ORDINARY CARBIDE TOOLS HAD FAILED

★ KENNAMETAL tools were used as standard on each of the jobs illustrated at left, after other carbide tools tested had failed to perform efficiently. All three operations were accomplished easily with KENNAMETAL, at the economical speeds and feeds mentioned.

Because of similar superior performances on many types of jobs, KENNAMETAL is decreasing machining time and saving money for manufacturers throughout the country. The KENNAMETAL representative in your district will gladly survey your tool requirements and demonstrate how KENNAMETAL can save you time and money. Write us.

*Invented and Manufactured in U.S.A.

McKENNA METALS Co.
147 LLOYD AVE., LATROBE, PENNA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)

Modern Tool Wks., Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Ct.
Reed-Prentice Corp., Worcester, Mass.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Sommer & Adams Co., Cleveland, O.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
U. S. Machine Tool Mfg. Corp., Terre Haute, Ind.
Vascoloy-Ramet Corp., No. Chicago, Ill.
Whitney Chain & Mfg. Co., Hartford, Conn. (For Woodruff Keys).

CUTTERS, RECONDITIONING

See Tool Reconditioning.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, etc.

CUTTING-OFF MACHINES

Avey Drilling Machine Co., Cincinnati.
Bardons & Oliver, Inc., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Mch. Tool Co., Jackson, Mich. (Lathe Type for Tubing).
Peerless Machine Co., Racine, Wis.

CUTTING-OFF MACHINES, ABRASIVE WHEEL

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee, Wis.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

CUTTING-OFF MACHINES, COLD SAW

See Sawing Machines, Circular.

CUTTING-OFF TOOLS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Carbide Fabricators Div., Morse Tool Co., Berkley, Mich.
Empire Tool Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Vascoloy-Ramet Corp., North Chicago, Ill.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

CUTTING-OFF TOOLS, CIRCULAR

Brown & Sharpe Mfg. Co., Providence.

CUTTING-OFF WHEELS, ABRASIVE

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

CYLINDER BORING MACHINES

Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., Detroit.
Moline Tool Co., Moline, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

CYLINDERS, HYDRAULIC

American Hollow Boring Co., Erie, Pa.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Denison Engineering Co., Columbus, O.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Hydraulic Products Co., 525 W. 76th St., Chicago.

CYLINDERS, PNEUMATIC

Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Products Co., 525 W. 76th St., Chicago.

DEALERS, MACHINERY

Besly, Chas. H., & Co., 120-B Clinton St., Chicago.
Earle Gear & Mch. Co., Philadelphia.
Hill Clarke Machinery Co., 649 Washington Blvd., Chicago.
Jefferson Machine Tool Co., Cincinnati, O.
Motch & Merryweather Mchy. Co., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Simmons Machine Tool Corp., Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

DESIGNERS, MACHINE AND TOOL

Bayard, M. L., & Co., Philadelphia, Pa.
Ex-Cell-O Corp., Detroit.
Hartford Special Mchry. Co., Hartford, Conn.
Ruthman Mchry. Co., Cincinnati.

DIAMONDS AND DIAMOND TOOLS

Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., 938 E. 41st St., Chicago, Ill.
Smit, J. K., & Co., 157 Chambers St., New York.

DIE CASTING MACHINES

Kux Machine Co., 3930-44 W. Harrison St., Chicago.
Madison-Kipp Corp., Madison, Wis.
Reed-Prentice Corp., Worcester, Mass.

DIE CASTINGS

See Castings, Die.

DIE CUSHIONS, PNEUMATIC

Clearing Mch. Corp., 6499 W. 65th St., Chicago.

MEMORANDUM

To Production Executives:

If material or specification changes are necessary—requiring changes in tools, feeds or speeds—check the cutting fluid factor with

Stuart Oil Engineering Service

Selecting the right cutting oil to fit conditions, which sometimes change over night, will eliminate one possible source of time-wasting, production-slowing trouble. We are equipped and ready to help you.

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LIQUID GRINDING COMPOUND
Meets every test for the ideal Modern Grinding Compound

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Recommended by America's leading machine tool builders

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For carbide tools and where an "aquamix" solution is recommended

Stuart's "Super-Kool"
AMERICA'S FIRST TRANSPARENT SULPHURIZED CUTTING AND DRAWING OIL

For All Cutting Fluid Problems
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Chicago, U.S.A. • LIMITED • Est. 1865
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Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIE MAKERS' SUPPLIES
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

DIE MAKING MACHINES
Grob Brothers, Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., Adrian, Mich.
Peerless Machine Co., Racine, Wis.

DIE SETS, STANDARD
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Ct.

DIE SINKING MACHINES
Cincinnati Milling Mch. Co., Cincinnati.
Gorton, George, Mch. Co., Racine, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIE SINKING PRESSES
Baldwin-Southwark Corp., Philadelphia, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS
See Stocks, Die.

DIES, LETTERING AND EMBOSSING
Noble & Westbrook Mfg. Co., Hartford, Ct.

DIES, SHEET METAL, ETC.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Columbus Die, Tool & Mch. Co., Columbus, O.
Ferracute Machine Co., Bridgeton, N. J.
Modern Machine Corp., Brooklyn, N. Y.
Niagara Mch. & Tool Wks., Buffalo, N. Y.
Pioneer Engineering & Mfg. Co., Detroit, Mich.
Ruthman Mchry. Co., Cincinnati, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.

DIES, THREADING
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.

DIES, THREADING, OPENING
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Lab., 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Wks., Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Oster Manufacturing Co., Cleveland, O.
Rickert-Shafer Co., Erie, Pa.

DIES, THREAD ROLLING
Hanson-Whitney Mch. Co., Hartford, Conn.
Pratt & Whitney Co., West Hartford, Conn.

DISCS, ABRASIVE
Abrasive Co., Bridesburg, Philadelphia, Pa.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Gardner Mch. Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Walls Sales Corp., 96 Warren St., New York.

DIVIDING HEADS
See Index Centers.

DOWEL PINS
Allen Mfg. Co., Hartford, Conn.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

DRESSERS, GRINDING WHEEL
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Carboloy Co., Inc., Detroit.
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., 938 East 41st St., Chicago.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Smit, J. K., & Co., 157 Chambers St., New York.
Standard Tool Co., Cleveland, O.

DRIFTS, DRILL
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Standard Tool Co., Cleveland, O.

DRILL HEADS, MULTIPLE
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Buhr Machine Tool Co., Ann Arbor, Mich.
Delta Mfg. Co., Milwaukee, Wis.
Errington Mechanical Lab., 200 Broadway, New York.
Ettco Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit.
Moline Tool Co., Moline, Ill.

DRILL SOCKETS
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILL SPEEDERS
Graham Mfg. Co., Inc., E. Greenwich, R. I.

DRILL STANDS
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
United States Electrical Tool Co., Cincinnati.

DRILLING MACHINES, AUTOMATIC
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Bodine Corp., Bridgeport, Ct.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.

DRILLING MACHINES, BENCH
Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Delta Mfg. Co., Milwaukee, Wis.
Dumore Co., Racine, Wis.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Fosdick Machine Tool Co., Cincinnati, O.

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Airplane fuselage hinge of duralumin produced complete per stroke on the Dieing Machine in continuous strip to high precision limits.

Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.

Of various cartridge clips produced on Dieing Machines, this one is for caliber .303 rifle, produced complete one per stroke at new high rate.

This shell, involving 8 operations, is produced complete one per stroke at high speed, with 1⅜" draw.

For bombers and bombs, precision stampings COMPLETE PER STROKE

Stampings produced complete per stroke on the unique Dieing Machine include many items for airplane fuselage, instrument and engine parts. In the endless variety of munitions items made on these automatic presses, are high-precision bomb components such as detonator parts, primer stampings, and automatic time and contact fuse parts and assemblies. Throughout the field of stampings essential to the war program, H & W Dieing Machines are providing an unmatched combination of high production and high precision of stamped product, one Dieing Machine replacing 5 to 10 conventional presses. At speeds up to 600 s.p.m., 1 to 20 completed parts are produced per stroke. Capacities: 10 tons to 300 tons.

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- Cartridge clips, or rifle chargers
- Gas mask stampings
- Ammunition stampings
- Bomb components
- Shell parts
- Detonator stampings
- Airplane instrument engine and fuselage parts

OPERATIONS
- Bullet assembling
- Primer inserting
- Automatic time and contact fuse assemblies

REQUEST CATALOG 42

THE HENRY & WRIGHT MFG. CO. 468 WINDSOR STREET HARTFORD, CONN.

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Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.

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Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Foote-Burt Co., Cleveland.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, GANG

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Production Machine Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Ct.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, HORIZONTAL DUPLEX

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes, W. F., & John, Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee, Wis.
Frew Machine Co., Philadelphia.
Kingsbury Mch. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Mch. & Tool Co., Detroit.
Sundstrand Mch. Tool Co., Rockford, Ill.

DRILLING MACHINES, MULTIPLE SPINDLE

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Baush Machine Tool Co., Springfield, Mass.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Greenlee Bros. & Co., Rockford, Ill.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Pratt & Whitney Co., West Hartford, Conn.
Production Mch. Co., Greenfield, Mass.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, RADIAL

American Tool Wks. Co., Cincinnati.
Carlton Machine Tool Co., Cincinnati.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Fosdick Machine Tool Co., Cincinnati, O.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, RAIL

See Drilling Machines, Gang.

DRILLING MACHINES, SENSITIVE

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Pratt & Whitney Co., West Hartford, Conn.
Production Mch. Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Ct.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Sibley Machine & Foundry Corp., South Bend, Ind.

DRILLING MACHINES, UPRIGHT

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Production Mch. Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Ct.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Sellers, Wm., & Co., Inc., Philadelphia.
Sibley Machine & Foundry Corp., South Bend, Ind.

DRILLING MACHINES, WALL RADIAL

Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, CENTER

Cleveland Twist Drill Co., Cleveland.
Gairing Tool Co., Detroit.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Slocomb, J. T., Co., Providence, R. I.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland.

DRILLS, CORE

Carboloy Co., Inc., Detroit.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Haynes Stellite Co., Kokomo, Ind.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, PORTABLE ELECTRIC

Black & Decker Mfg. Co., Towson, Md.
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
United States Electrical Tool Co., Cincinnati.

DRILLS, PORTABLE PNEUMATIC

Rotor Tool Co., Cleveland, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.

DRILLS, RATCHET

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, TWIST

Ampco Twist Drill Co., Jackson, Mich.
Black Drill Co., Cleveland, O.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, WIRE

Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

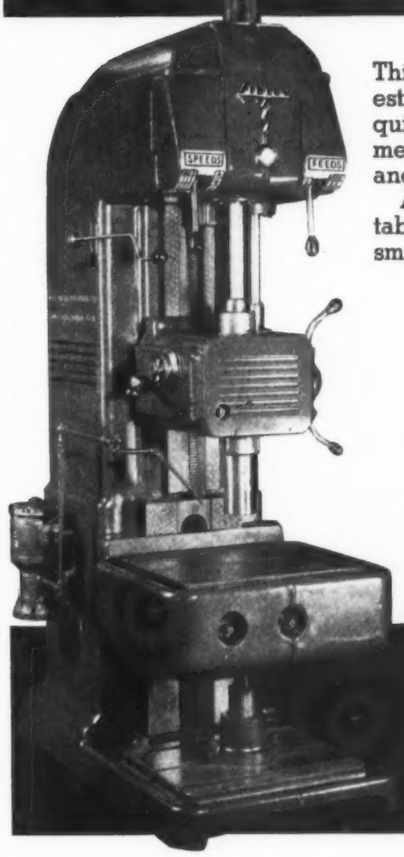
DRIVES, MOTORIZED BELT

Cullman Wheel Co., 1339 Altgeld St., Chicago.
Turner Uni-Drive Co., Kansas City, Mo.

DUPLICATORS

Detroit Universal Duplicator Co., Detroit, Mich.

NEW SIBLEY 25" GEARED DRILLING MACHINE



This new Sibley will handle the toughest jobs you've got—and do them quicker and at lower cost. It has tremendous power, extreme accuracy and maximum operating convenience.

All controls centered at front—table surface is extra large—operates smoothly, quietly and at high speed.

- ★ **Anti-friction bearings throughout.**
- ★ **Heat treated, alloy steel gears.**
- ★ **Multi-splined shafts throughout.**
- ★ **Internal and external involute tooth clutches.**
- ★ **Speed and feed mechanisms cam operated.**
- ★ **Transmission operates in oil bath.**
- ★ **Tapping electrically controlled.**

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75 to 1500 RPM
50 to 1000 RPM
35 to 665 RPM
26 to 500 RPM
17 to 332 RPM
11 to 222 RPM

FEEDS AVAILABLE
.005 to .045
.009 to .083

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Boston, Mass. .....Lynd-Farquhar Company
Buffalo, N. Y.....R. L. Crane Company
Chicago, Ill.....Federal Machinery Sales Co.
Cleveland, Ohio.....Reynolds Mach. Company
Dallas, Texas.....Hamilton-Huster Mach. Co.
Dayton, Ohio....C. H. Gosiger Machinery Co.
Detroit, Mich.....James W. George Mach. Co.
Houston, Texas.....Wessendorff-Nelms & Co.
Indianapolis, Ind...Indianapolis Mach. & Sup.
Kansas City, Mo.....English Bros. Mach. Co.
Los Angeles, Cal.....Smith-Booth-Usher Co.
Melbourne, Fla.....Mr. William Rath
Montreal, Que., Can...Moore Bros. Mach. Co.
New Orleans, La.....Murray-Baker-Frederic
New York, N. Y.....Vandyck Churchill Co.
Philadelphia, Pa.....Swind Machinery Co.
Pittsburgh, Pa.....Barney Machinery Co.
Portland, Ore.....Portland Machinery Co.
Richmond, Va.....Smith-Courtney Company
Rochester, N. Y.....F. W. Schiefer Mach. Co.
Salt Lake City, Utah.....Lang Company
San Francisco, Cal.....Machinery Sales Co.
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SIBLEY MACHINE & FOUNDRY CORP.

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Covel Mfg. Co., Benton Harbor, Mich.
Pangborn Corp., Hagerstown, Md.

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Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

EMERY WHEELS
See Grinding Wheels.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

ENGRAVING MACHINES
Gorton, George, Mch. Co., Racine, Wis.
United States Electrical Tool Co., Cincinnati.

EXTRACTORS, SCREW
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

FACING MACHINE
Ex-Cell-O Corp., Detroit.

FANS, EXHAUST, ELECTRIC VENTILATING
General Electric Co., Schenectady, N. Y.
Wagner Electric Co., St. Louis, Mo.

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Cleveland Punch & Shear Works Co., Cleveland, O.
S. & S. Machine Wks., 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.
V & O Press Co., Hudson, N. Y.

FILES
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Nicholson File Co., Providence.

FILES, MACHINE
Oliver Instrument Co., Adrian, Mich.

FILES, ROTARY
Jarvis, Chas. L., Co., Middletown, Ct.
Lewis, B. C., Mfg. Co., Brooklyn, N. Y.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.

FILTERS, AIR
United States Electrical Tool Co., Cincinnati.

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Ames, B. C., Co., Waltham, Mass.
Continental Machines, Inc., Minneapolis, Minn.
Grob Brothers, Grafton, Wis.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Ct.
Oliver Instrument Co., Adrian, Mich.
Stow Mfg. Co., Binghamton, N. Y.

FITTINGS, HYDRAULIC
Hydraulic Press Mfg. Co., Mount Gilead, O.
Watson-Stillman Co., Roselle, N. J.

FLEXIBLE COUPLINGS
See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Dumore Co., Racine, Wis.
Foredom Electric Co., 27 Park Place, New York.
Haskins, R. G., Co., 617 So. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Ct.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.

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Baldwin-Southwark Corp., Philadelphia, Pa.

FORGINGS, DROP
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

FORGINGS, HOLLOW BORED
American Hollow Boring Co., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

FORGINGS, IRON AND STEEL
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
Morgan Engineering Co., Alliance, O.

FORGINGS, MANGANESE, BRONZE, ETC.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

FORGINGS, UPSET
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd. Chicago.
Williams, J. H., & Co., 225 Lafayette St. New York, N. Y.

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Baldwin-Southwark Corp., Philadelphia, Pa.
Bethelhem Steel Co., Bethlehem, Pa.
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Yoder Co., Cleveland, O.

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U. S. Tool Company, Inc., Ampere, N. J.

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Firth-Sterling Steel Co., McKeesport, Pa.
National Broach & Mch. Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.

FRAMES, MACHINERY, WELDED
Mahon, R. C., Co., Detroit, Mich.

FURNACES, EQUIPMENT FOR LOADING
Hydraulic Products Co., 525 W. 76th St., Chicago.

FURNACES, HARDNESS
Leeds & Northrup Co., Philadelphia.

FURNACES, HEAT-TREATING ELECTRIC
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

FURNITURE, SHOP
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Pratt & Whitney Co., West Hartford, Conn.

GAGES, COMPARATOR
Comtor Co., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.
Sheffield Corporation, Dayton, O.

GAGES, DEPTH
Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence, R. I.
Slocomb, J. T., Co., Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, DIAL
Ames, B. C., Co., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence, R. I.
Sheffield Corporation, Dayton, O.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, ELECTRIC
Pratt & Whitney Co., West Hartford, Conn.

GAGES, HEIGHT
Brown & Sharpe Mfg. Co., Providence.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, PLUG, RING AND SNAP
Axelson Mfg. Co., Los Angeles, Calif.
Brown & Sharpe Mfg. Co., Providence.
Carboloy Co., Inc., Detroit.
Ex-Cell-O Corporation, Detroit.
Federal Products Corp., Providence, R. I.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Sheffield Corporation, Dayton, O.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, SURFACE
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Columbus Die, Tool & Mch. Co., Columbus, O.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, TAPER
Brown & Sharpe Mfg. Co., Providence.
Pratt & Whitney Co., West Hartford, Conn.
Sheffield Corporation, Dayton, O.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

GAGES, THREAD
Axelson Mfg. Co., Los Angeles, Calif.
Bath, John, & Co., Inc., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.
Sheffield Corporation, Dayton, O.
Starrett, L. S., Co., Athol, Mass.

GASKETS
Garlock Packing Co., Palmyra, N. Y.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

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Braun Gear Co., Brooklyn, N. Y.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

GEAR BURNISHING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit, Mich.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Michigan Tool Co., Detroit, Mich.
National Broach & Mch. Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.

GEAR CUTTING MACHINES, BEVEL (GENERATOR)
Bilgram Gear & Machine Wks., Philadelphia.
Gleason Works, Rochester, N. Y.

(ROTARY CUTTER)
Newark Gear Cutting Machine Co., Newark, N. J.
Producto Machine Co., Bridgeport, Ct.
Waltham Mch. Wks., Waltham, Mass.

GEAR CUTTING MACHINES, HELICAL & SPUR (HOB)
Barber-Colman Co., Rockford, Ill.
Lees-Bradner Co., Cleveland.
Michigan Tool Co., Detroit, Mich.
Newark Gear Cutting Machine Co., Newark, N. J.
New Jersey Gear & Mfg. Co., Newark, N. J.

(SHAPER OR PLANER TYPE)
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Fellows Gear Shaper Co., Springfield, Vt.

GEAR CUTTING MACHINES, SPIRAL-BEVEL
Gleason Works, Rochester, N. Y.

GEAR CUTTING MACHINES, WORM AND WORM WHEELS
Barber-Colman Co., Rockford, Ill.
Fellows Gear Shaper Co., Springfield, Vt. (Straight & Hourglass Type).
Lees-Bradner Co., Cleveland.
Michigan Tool Co., Detroit, Mich.
New Jersey Gear & Mfg. Co., Newark, N. J.
Producto Machine Co., Bridgeport, Ct.

GEAR FINISHING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit, Mich.

GEAR GRINDING MACHINES
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Gleason Works, Rochester, N. Y.
Pratt & Whitney Co., West Hartford, Conn.

GEAR HARDENING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

GEAR LAPPING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit, Mich.
National Broach & Mch. Co., Detroit.

GEAR MOTORS
See Speed Reducers.

GEAR SHAVING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
National Broach & Mch. Co., Detroit.

GEAR TESTING MACHINERY
Baldwin-Southwark Corp., Philadelphia, Pa.
Brown & Sharpe Mfg. Co., Providence.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Lees-Bradner Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Newark Gear Cutting Machine Co., Newark, N. J.
Pratt & Whitney Co., West Hartford, Conn.

GEAR TOOTH GRINDING MACHINES
Lees-Bradner Co., Cleveland.
Pratt & Whitney Co., West Hartford, Conn.

GEARS, CUT
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Baush Machine Tool Co., Springfield, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Machine Works, Philadelphia.
Braun Gear Co., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Gear Co., Cincinnati, O.
Cleveland Worm & Gear Co., Cleveland.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mch. Co., Philadelphia.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Pittsfield, Mass.
Gleason Works, Rochester, N. Y.
Grant Gear Wks., Inc., Boston, Mass.
Hartford Special Mchy. Co., Hartford, Conn.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Lees-Bradner Co., Cleveland.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Michigan Tool Co., Detroit, Mich.
Newark Gear Cutting Machine Co., Newark, N. J.
New Jersey Gear & Mfg. Co., Newark, N. J.
Ohio Gear Co., Cleveland, O.
Perkins Mch. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia.
Pittsburgh Gear & Machine Co., Pittsburgh.
Stahl Gear & Machine Co., Cleveland.
Taylor Mch. Co., Cleveland.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GEARS MOLDED
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Philadelphia Gear Works, Philadelphia.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GEARS, RAWHIDE AND NON-METALLIC
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Braun Gear Co., Brooklyn, N. Y.

Cincinnati Gear Co., Cincinnati, O.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mch. Co., Philadelphia.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Pittsfield, Mass.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mchy. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Philadelphia Gear Works, Philadelphia.
Pittsburgh Gear & Machine Co., Pittsburgh.
Stahl Gear & Machine Co., Cleveland.
Taylor Mch. Co., Cleveland.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GENERATORS, ELECTRIC

General Electric Co., Schenectady, N. Y.
Janette Mfg. Co., 556 W. Monroe St., Chicago.
Reliance Electric & Mfg. Co., Cleveland.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GRADUATING MACHINES

Gorton, George, Mch. Co., Racine, Wis.
Noble & Westbrook Mfg. Co., Hartford, Ct.

GREASE

Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

GRINDERS, CARBIDE TOOL

Baldor Electric Co., St. Louis, Mo.
Oliver Instrument Co., Adrian, Mich.
Sundstrand Mch. Tool Co., Rockford, Ill.

GRINDERS, DIE AND MOLD

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
United States Electrical Tool Co., Cincinnati.

GRINDERS, OILSTONE, FOR WOODWORKING TOOLS

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, PNEUMATIC

Madison-Kipp Corp., Madison, Wis.
Rotor Tool Co., Cleveland, O.

GRINDERS, PORTABLE ELECTRIC AND TOOLPOST

Black & Decker Mfg. Co., Towson, Md.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Ct.
Schauer Machine Co., Cincinnati, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.
United States Electrical Tool Co., Cincinnati.

GRINDING MACHINES, ABRASIVE BELT

Continental Machines, Inc., Minneapolis, Minn.
Delta Mfg. Co., Milwaukee, Wis.
Hill Acme Co., Cleveland, O.
Mattison Mch. Wks., Rockford, Ill.
Production Machine Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., 96 Warren St., New York.

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Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md.
Delta Mfg. Co., Milwaukee, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schauer Machine Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.

GRINDING MACHINES, CAMSHAFT

Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CEMENTED CARBIDE TOOL

Carboloy Co., Inc., Detroit.
Ex-Cell-O Corporation, Detroit.
Oliver Instrument Co., Adrian, Mich.

GRINDING MACHINES, CENTERLESS

Cincinnati Grinders Inc., Cincinnati.

GRINDING MACHINES, CHASER, OR DIE

Eastern Mch. Screw Corp., New Haven, Conn.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CHUCKING

Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass

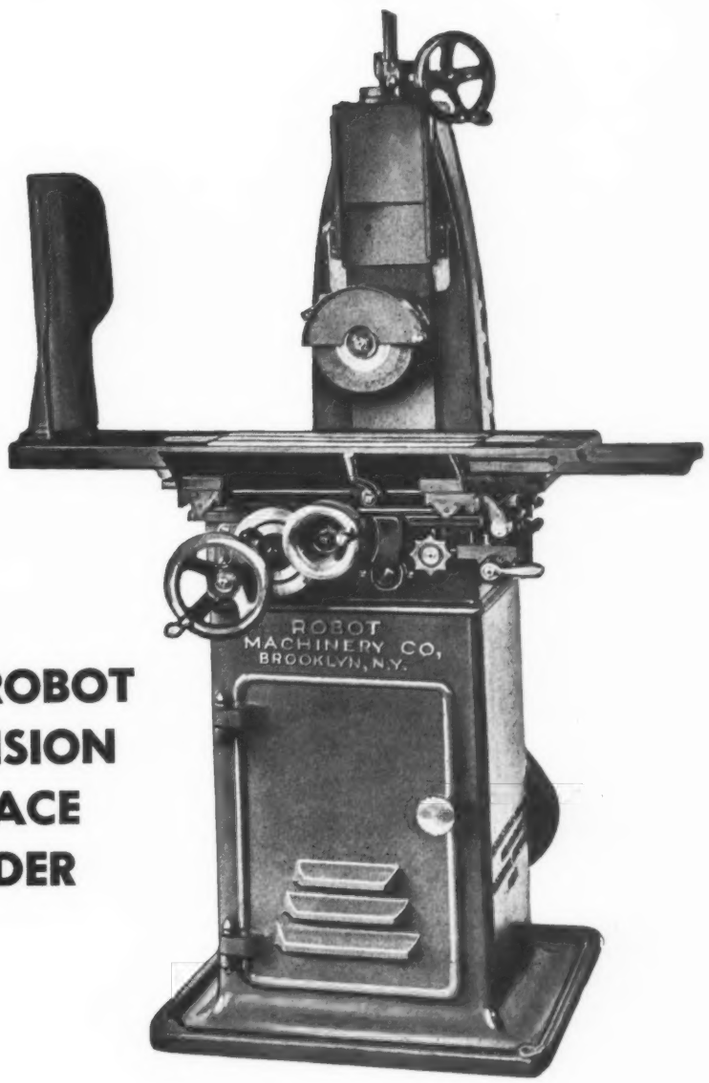
GRINDING MACHINES, CRANKSHAFT

Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CYLINDER

Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Hill, Clarke Mchy. Co., 649 Washington Blvd., Chicago.
Landis Tool Co., Waynesboro, Pa.

SPEED—ON MUNITIONS AND AIRCRAFT JOBS



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Brown & Sharpe Mfg. Co., Providence.
Cincinnati Grinders Inc., Cincinnati.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Thompson Grinder Co., Springfield, Ohio.
United States Electrical Tool Co., Cincinnati.

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Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Production Mch. Co., Greenfield, Mass.
United States Electrical Tool Co., Cincinnati.

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Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee, Wis.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers, Wm., & Co., Inc., Philadelphia.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, FACE
Abrasive Mch. Tool Co., E. Providence, R. I.
Diamond Machine Co., Philadelphia, Pa.
Hanchett Mfg. Co., Big Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.

GRINDING MACHINES, FLEXIBLE SHAFT
See Flexible Shaft Equipment.

GRINDING MACHINES FOR SHARPENING TURNING AND PLANING TOOLS
Delta Mfg. Co., Milwaukee, Wis.
General Machinery Corp., Boston, Mass.
Oliver Instrument Co., Adrian, Mich.
Production Mch. Co., Greenfield, Mass.
Sellers, Wm., & Co., Inc., Philadelphia. (Machine Ground).
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Mch. Wks., Waltham, Mass.

GRINDING MACHINES, INTERNAL
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sav-way Tool & Machining Co., Detroit, Mich.

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Heald Machine Co., Worcester, Mass.

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Landis Tool Co., Waynesboro, Pa.

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Sundstrand Mch. Tool Co., Rockford, Ill.

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Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.

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Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland, O.
Leach, H., Machinery Co., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Norton Co., Worcester, Mass.
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Robot Machinery Co., 326 Ten Eyck St., Brooklyn, N. Y.
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Sommer & Adams Co., Cleveland, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., Springfield, Ohio.
United States Electrical Tool Co., Cincinnati.
Walker, O. S., Co., Inc., Worcester, Mass.

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Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
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Cincinnati Milling Mch. Co., Oakley, Cincinnati.
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Landis Tool Co., Waynesboro, Pa.
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Norton Co., Worcester, Mass.
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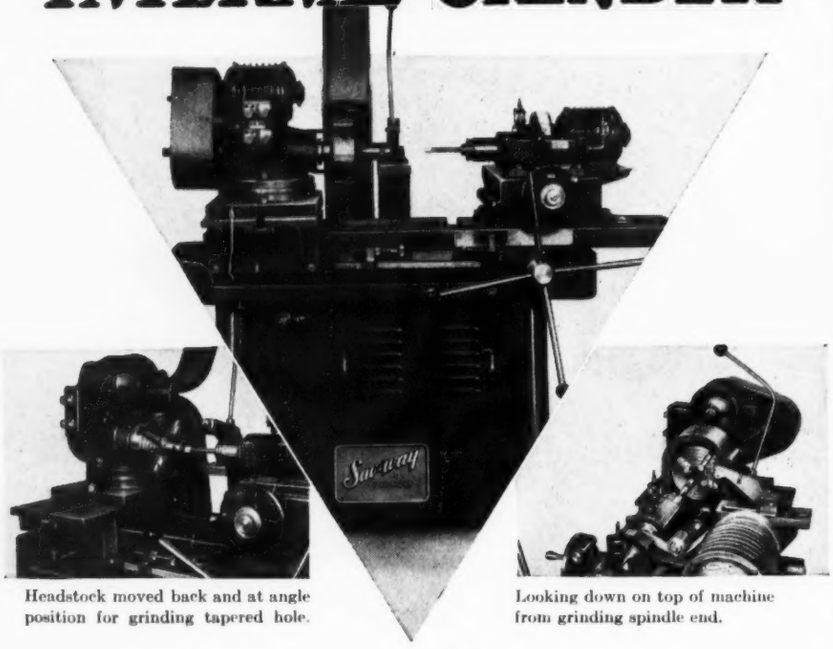

Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

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See Boring Machines, Jig.

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Lodge & Shipley Mch. Tool Co., Cincinnati.
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Sundstrand Mch. Tool Co., Rockford, Ill.

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Springfield Mch. Tool Co., Springfield, O.
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Sundstrand Mch. Tool Co., Rockford, Ill.

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Bradford Machine Tool Co., Cincinnati, O.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
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Lodge & Shipley Mch. Tool Co., Cincinnati.
Monarch Mch. Tool Co., Sidney, O.
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Reed-Prentice Corp., Worcester, Mass.
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Rockford Mch. Tool Co., Rockford, Ill.
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Lodge & Shipley Mch. Tool Co., Cincinnati.
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Warner & Swasey Co., Cleveland.

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See Chucking Machines.

LATHES, TOOLROOM
See Lathes, Engine and Toolroom.

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Bullard Company, Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Diehl, G. M., Machine Works, Wabash, Ind.
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Oster Mfg. Co., Cleveland, O.
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Springfield Mch. Tool Co., Springfield, O.
Warner & Swasey Co., Cleveland.

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Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mch. Co., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Calif.
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Producto Machine Co., Bridgeport, Ct.
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Van Norman Machine Tool Co., Springfield, Mass.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Continental Machines, Inc., Minneapolis, Minn.
Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Cal.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, Ohio.
Sommer & Adams Co., Cleveland, O.
Sundstrand Machine Tool Co., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Gorton, George, Mch. Co., Racine, Wis.

MOLDING MACHINES, PLASTIC PRODUCTS
Hydraulic Press Mfg. Co., Mount Gilead, O.
Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLYBDENUM
Climax Molybdenum, 500 Fifth Ave., New York.

MOTORIZED SPEED REDUCERS
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.

MOTORS, ELECTRIC
Baldor Electric Co., St. Louis, Mo.
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Janette Mfg. Co., 556 W. Monroe St., Chicago.
Lincoln Electric Co., Cleveland.
Reliance Electric & Engrg. Co., Cleveland.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., E. Pittsburgh.

MULTIPLE-SLIDE FORMING MACHINES
Baird Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., Ampere, N. J.

NAME PLATES
Horan, 44 W. 28th St., New York.
Jefferson Machine Tool Co., Cincinnati, Ohio.
Noble & Westbrook Mfg. Co., Hartford, Ct.

NIBBLING MACHINES
Gray Machine Co., Philadelphia.
Schatz Mfg. Co., Poughkeepsie, N. Y.

NICKEL
International Nickel Co., 67 Wall St., New York.

NIPPLE THREADING MACHINERY
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.

NUMBERING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Ct.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Machinery.

NUTS, COLD FORGED, WING AND CAP
Parker-Kalon Corp., 200 Varick St., New York.

NUTS, SELF-LOCKING
Elastic Stop Nut Corp., Union, N. J.

NUTS, THUMB OR WING AND CAP
Williams, J. H., & Co., 225 Lafayette St., New York.

OIL CUPS
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OIL GROOVERS
Hanson-Whitney Mch. Co., Hartford, Conn.

OIL HOLE COVERS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Madison-Kipp Corp., Madison, Wis.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OILS, CUTTING
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, LUBRICATING
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, QUENCHING AND TEMPERING
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.

OILS, SOLUBLE—See Compounds, Cutting, Grinding Metal Drawing, etc.

OPTICAL WORK-LOCATING INSTRUMENTS
Center Scope Instrument Co., Los Angeles, Calif.

PACKING, LEATHER, METAL, RUBBER, ASBESTOS, ETC.
Garlock Packing Co., Palmyra, N. Y.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
Houghton, E. F., & Co., Philadelphia, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Watson-Stillman Co., Roselle, N. J.

PARALLELS
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, WOOD
Mummert-Dixon Co., Hanover, Pa.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS
Hill Acme Co., Cleveland, O.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Norma-Hoffmann Bearing Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE CUTTING AND THREADING MACHINES
Foote-Burt Co., Cleveland.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.
Peerless Machine Co., 1613 Racine St., Racine, Wis.

PIPE, IRON AND STEEL
Republic Steel Corp., Cleveland, O.

PIPE, STEEL
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

PIPE TONGS
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

PLANER ATTACHMENTS
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hanson-Whitney Mch. Co., Hartford, Conn.

PLANERS
Baldwin-Southwark Corp., Philadelphia, Pa.
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y. (Incl. Plate, Rotary & Crank Types).
Ohio Machine Tool Co., Kenton, O.
Rockford Mch. Tool Co., Rockford, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

PLANERS, OPEN-SIDE
Cincinnati Planer Co., Cincinnati.

PLASTICS AND PLASTIC PRODUCTS
Bakelite Corp., 30 E. 42nd St., New York.

PLATE ROLLS
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.

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PLATES, SURFACE
Brown & Sharpe Mfg. Co., Providence.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Rotor Tool Co., Cleveland, O.
Smith Tool Works, Inc., Bucyrus, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Company, Inc., Ampere, N. J.

PNEUMATIC EQUIPMENT
Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

POLISHING LATHES AND MACHINES
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Continental Machines, Inc., Minneapolis, Minn.
Gardner Machine Co., Beloit, Wis.
Production Mch. Co., Greenfield, Mass.
Schauer Machine Co., Cincinnati, O.
Sundstrand Mch. Tool Co., Rockford, Ill.
United States Electrical Tool Co., Cincinnati.

POLISHING TOOLS, PORTABLE
Jarvis, Chas. L., Co., Middletown, Ct.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.

PORTABLE ELECTRIC DRILLS, REAMERS, TAPPERS, ETC.
Black & Decker Mfg. Co., Towson, Md.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
Famco Machine Co., Racine, Wis.
Farquhar, A. B., Co., Ltd., York, Pa.
General Manufacturing Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.

PRESSES, BROACHING
American Broach & Mch. Co., Ann Arbor, Mich.
Ferracute Machine Co., Bridgeton, N. J.
General Manufacturing Co., Detroit, Mich.
Lapointe Machine Tool Co., Hudson, Mass.
V & O Press Co. Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.

PRESSES, EXTRUSION
Hydraulic Press Mfg. Co., Mount Gilead, O.
Watson-Stillman Co., Roselle, N. J.

PRESSES, FOOT
Baird Machine Co., Bridgeport, Conn.
Etna Machine Co., Toledo, O.
Famco Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Wks., Buffalo, N. Y.
V & O Press Co., Hudson, N. Y.

PRESSES, FORGING
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Farquhar, A. B., Co., Ltd., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, HYDRAULIC
American Broach & Mch. Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Denison Engineering Co., Columbus, O.
Diamond Machine Co., Philadelphia, Pa.
Farquhar, A. B., Co., Ltd., York, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lapointe Machine Tool Co., Hudson, Mass.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.
Wood, R. D., Co., Philadelphia, Pa.

PRESSES, PERCUSSION
Wilson, K. R., Buffalo, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SCREW
Ferracute Machine Co., Bridgeton, N. J.
General Manufacturing Co., Detroit, Mich.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SHEET METAL WORKING
Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Cincinnati.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., Racine, Wis.
Farquhar, A. B., Co., Ltd., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, O.
L & J Press Corp., Elkhart, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, STRAIGHTENING
Baldwin-Southwark Corp., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Farquhar, A. B., Co., Ltd., York, Pa.
General Manufacturing Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Morgan Engineering Co., Alliance, O.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PROFILING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Frew Machine Co., Philadelphia.
Gorton, George, Mch. Co., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.
Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

PULLEYS
Continental Machines, Inc., Minneapolis, Minn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.
Sellers, Wm., & Co., Inc., Philadelphia.

PULLEYS, FRICTION CLUTCH
Brown & Sharpe Mfg. Co., Providence.
Hill Acme Co., Cleveland.
Jones, W. A., Fdry. & Mch. Co., 4409 W. Roosevelt Rd., Chicago.

PUMPS, COOLANT, LUBRICANT AND OIL
Brown & Sharpe Mfg. Co., Providence.
Estey Pump Co., Inc., Canandaigua, N. Y.
Pioneer Engineering & Mfg. Co., Detroit, Mich.
Ruthman Machinery Co., Cincinnati.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, HYDRAULIC
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence.
Lapointe Machine Tool Co., Hudson, Mass.
Racine Tool & Mch. Co., Racine, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.
Tuthill Pump C., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.
Watson-Stillman Co., Roselle, N. J.

PUMPS, ROTARY
Pioneer Engineering & Mfg. Co., Detroit, Mich.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES
See Dies, Sheet Metal, etc.

PUNCHES, CENTERING
Cleveland Punch & Shear Works Co., Cleveland, O.
Slocomb, J. T., Co., Providence, R. I.

PUNCHING MACHINERY
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Harnifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
Watson-Stillman Co., Roselle, N. J.
Wiedemann Machine Co., Philadelphia.

PUNCHING AND RIVETING MACHINES
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

PYROMETERS
Leeds & Northrup Co., Philadelphia.
Shore Instrument & Mfg. Co., Jamaica, N. Y.

RACKS, GEAR, CUT
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Brown & Sharpe Mfg. Co., Providence.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hartford Special Mchry. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.

REAMER HOLDERS
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Landis Mch. Co., Inc., Waynesboro, Pa.
Lipe-Rollway Corporation, Syracuse, N. Y.
McCrosky Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Warner & Swasey Co., Cleveland.

REAMERS
Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland, O.
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Columbus Die, Tool & Mch. Co., Columbus, O.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gammons-Hoaglund Co., Manchester, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Lipe-Rollway Corporation, Syracuse, N. Y.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

REAMERS, ADJUSTABLE
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Madison Mfg. Co., Muskegon, Mich.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, TAPER PIN
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Gammons-Hoaglund Co., Manchester, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lipe-Rollway Corporation, Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES
Van Norman Mch. Tool Co., Springfield, Mass.

RECORDING INSTRUMENT FOR COUNTING
National Acme Co., Cleveland.

RECORDING INSTRUMENTS FOR ELECTRICITY
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR PRESSURE
Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR SPEED
Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR TEMPERATURE
Leeds & Northrup Co., Philadelphia, Pa.

REELS, STOCK, STANDARD AND AUTOMATIC
S. & S. Mch. Wks., 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

REFRACTORIES, HEAT TREATING FURNACE
Norton Co., Worcester, Mass.

REGULATORS, TEMPERATURE
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.

REMOVERS, JAPAN, ENAMEL, ETC.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.

RHEOSTATS
Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET-MAKING MACHINES
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.

RIVET SETS
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.

RIVETERS, HYDRAULIC
Bethlehem Steel Co., Bethlehem, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Morgan Engineering Co., Alliance, O.

RIVETERS, PNEUMATIC
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

RIVETING MACHINES
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Producto Machine Co., Bridgeport, Ct.

RUBBER PRODUCTS
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

RULES, STEEL
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

RUST PREVENTIVE
Houghton, E. F., & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.

SAFETY GUARDS FOR PUNCH PRESSES
Taylor-Shantz, Inc., Rochester, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment.

SANDERS
Black & Decker Mfg. Co., Towson, Md.
Jarvis, Chas. L., Co., Middletown, Ct.
Jefferson Machine Tool Co., Cincinnati, Ohio.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Rotor Tool Co., Cleveland, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.
Stow Mfg. Co., Binghamton, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
United States Electrical Tool Co., Cincinnati.
Walls Sales Corp., 96 Warren St., New York.

SAW BLADES, HACK
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Starrett, L. S., Co., Athol, Mass.

SAW FILING MACHINES
Wardwell Mfg. Co., Cleveland, O.

SAW SETTING MACHINES, CIRCULAR
Wardwell Mfg. Co., Cleveland, O.

SAW SHARPENING MACHINES
Covel Mfg. Co., Benton Harbor, Mich.
Earle Gear & Mch. Co., Philadelphia.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Wardwell Mfg. Co., Cleveland, O.

SAWING MACHINES, CIRCULAR
Consolidated Mch. Tool Corp., Rochester, N. Y.
Earle Gear & Mch. Co., Philadelphia.
Etna Machine Co., Toledo, O.
Motch & Merryweather Mchy. Co., Cleveland, O.

SAWING MACHINES, FRICTION
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, METAL CUTTING BAND
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Avey Drilling Machine Co., Cincinnati.
Continental Machines, Inc., Minneapolis, Minn.
Delta Mfg. Co., Milwaukee, Wis.
Grob Brothers, Grafton, Wis.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Racine Tool & Mch. Co., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, POWER HACK
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Covel Mfg. Co., Benton Harbor, Mich.
Peerless Machine Co., 1613 Racine, Wis.
Racine Tool & Mch. Co., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, WOOD
Delta Mfg. Co., Milwaukee, Wis.

SAWS, CIRCULAR METAL CUTTING
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Huther Bros Saw Mfg. Co., Inc., Rochester, N. Y.
Illinois Tool Wks., 2501 No. Keeler Ave., Chicago.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, HOLE
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAWS, METAL CUTTING BAND
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Delta Mfg. Co., Milwaukee, Wis.
DoAll Co., Inc., Des Plaines, Ill.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
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Walker-Turner Co., Inc., Plainfield, N. J.
Wells Manufacturing Corp., Three Rivers, Mich.

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Skilsaw, Inc., 5039 Elston Ave., Chicago.

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Brown & Sharpe Mfg. Co., Providence.
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National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Starrett, L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCREW CUTTING TOOLS—See Taps and Dies.

SCREW DRIVING AND NUT SETTING EQUIPMENT
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Errington Mechanical Laboratory, 200 Broadway, New York.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Ct.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati.

SCREW MACHINES, AUTOMATIC SINGLE AND MULTIPLE SPINDLE
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Cone Automatic Machine Co., Inc., Windsor, Vt.
Foote-Burt Co., Cleveland, O.
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland.

SCREW MACHINES, HAND
See also Lathes, Turret.
Acme Machine Tool Co., Cincinnati, O.
Bardons & Oliver, Inc., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Gisholt Mch. Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Simmons Machine Tool Corp., Albany, N. Y.
Warner & Swasey Co., Cleveland.

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Brown & Sharpe Mfg. Co., Providence.
Cleveland Automatic Machine Co., Cleveland, O.
Gisholt Mch. Co., Madion, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
New Britain-Gridley Machine Div., New Britain Machine Co., New Britain, Ct.
Potter & Johnston Machine Co., Pawtucket, R. I.
R & L Tools, Nicetown, Philadelphia.
Warner & Swasey Co., Cleveland.

SCREW MACHINE WORK
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland.
Standard Pressed Steel Co., Jenkintown, Pa.

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Parker, Chas., Co., Meriden, Conn.
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Pawtucket Screw Co., Pawtucket, R. I.
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Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

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Simmons Machine Tool Corp., Albany, N. Y.
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Stow Mfg. Co., Binghamton, N. Y.
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Bethlehem Steel Co., Bethlehem, Pa.

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National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
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Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

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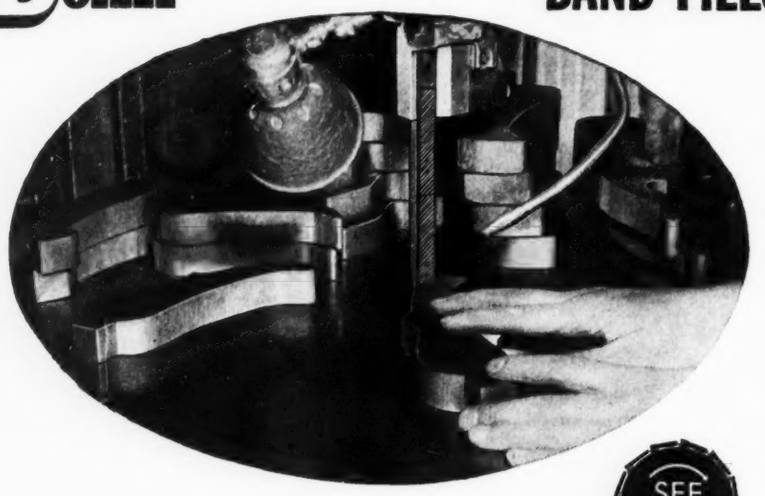

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General Electric Co., Schenectady, N. Y.
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STEEL ALLOYS

See Alloy-steels.

STEEL BARS

See Bars, Steel.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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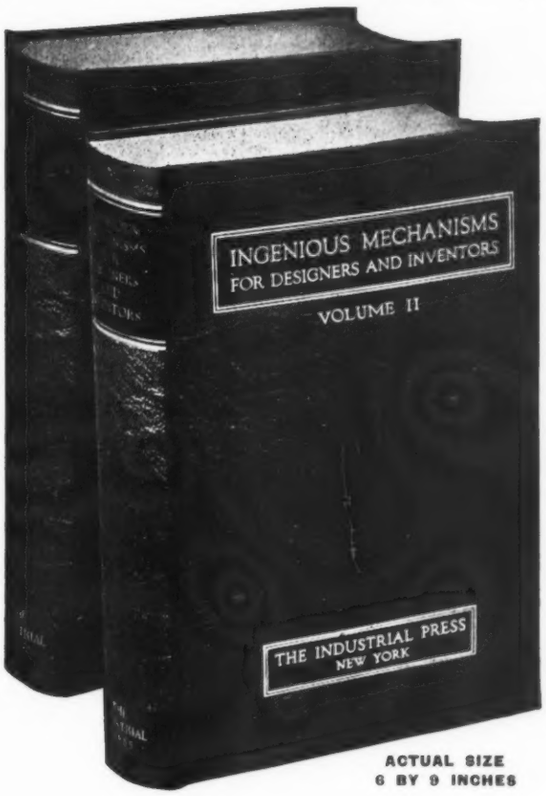

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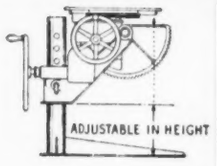

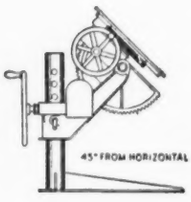

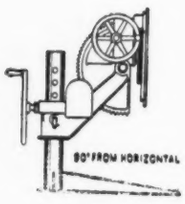

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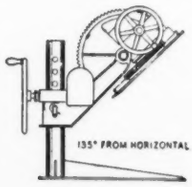

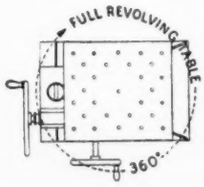

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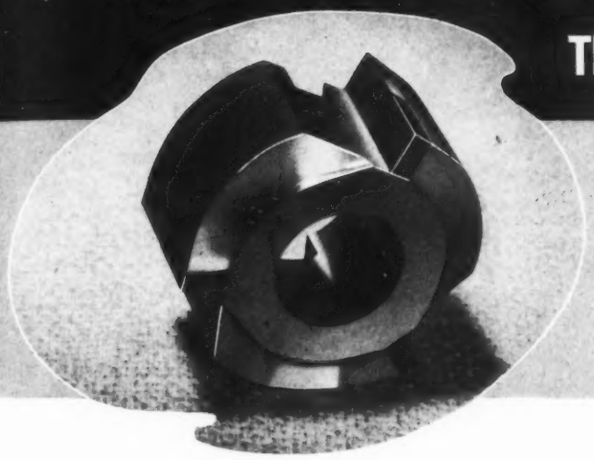

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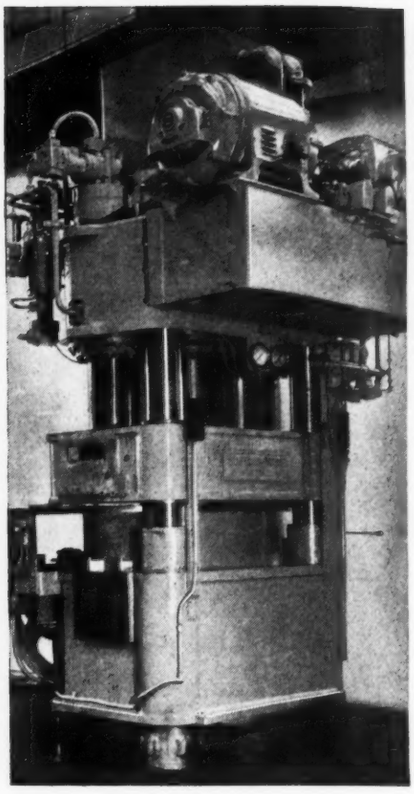

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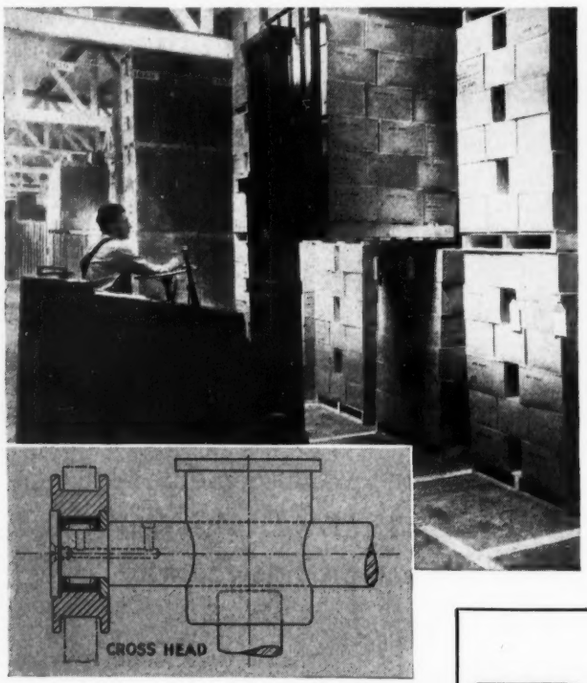

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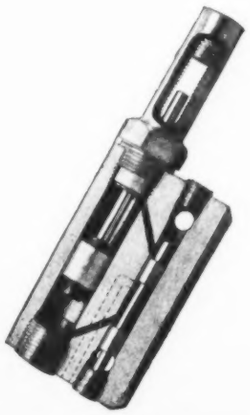

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